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BRITISH ANTARCTIC ("TERRA NOVA") EXPEDITION, 1910.

NATURAL HISTORY REPORTS.

ZOOLOGY. VOL. II.

**COLLECTING STATIONS,
MOLLUSCA, BRACHIOPODA,
AND WORMS.**



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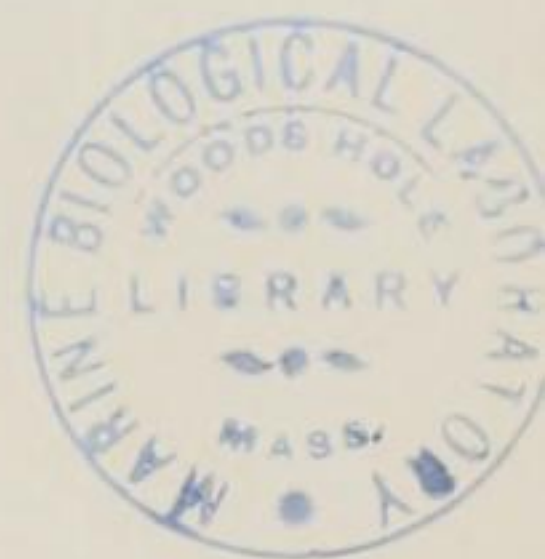
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NEMERTINEA.

BY H. A. BAYLIS, B.A.

WITH FOUR FIGURES IN THE TEXT AND PLATES I-II.



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I.—GENERAL.

THE Nemertinea collected by the “Terra Nova” came, for the most part, from the Antarctic and Subantarctic regions, chiefly from dredging-stations in the Ross Sea and McMurdo Sound.

Three species, each represented by a single specimen, were captured off New Zealand.

The total number of species in the collection is small, and of this number very few are certainly new to science. A survey of the whole collection gives the following results :—

Total number of species, 10.
Previously described species, 5.
New species, 2.
Doubtful species, 3.

The previously described species are the following :—

(a) From the Antarctic regions :—

Amphiporus moseleyi, Hubr.

Amphiporus multihastatus, Joubin.

Prostoma unilineatum (Joubin).

Lineus corrugatus, M'Int.

(b) From New Zealand:—

Baseodiscus giardii (Hubr.).

The two forms described as new are:—

Baseodiscus antarcticus, sp. n., and

Lineus scotti, sp. n.,

both from the Antarctic regions.

The three doubtful forms are:—

(a) From the Antarctic regions:—

A very small specimen, apparently belonging to the genus *Cerebratulus*, and probably very young.

(b) From New Zealand:—

Two species probably belonging to the genus *Lineus*, each represented by one specimen only. They are referred to in the sequel as *Lineus*, spp. "A" and "B."

The material on the whole is very well preserved, and no difficulty, on the ground of preservation, has been experienced in making out microscopic details by means of sections or otherwise. On the other hand, the number of specimens in some cases is so small that it was thought undesirable to dissect them to any great extent, and the accounts given of their structure must be regarded as subject to modification at some future time, when more abundant material may be available.

It is a matter for regret that almost no record appears to have been kept of the colours and markings of the various species during life. The specimens, by the time that they were handed over to me for study, were all, with a very few exceptions which will be mentioned in their appropriate places, deprived of all traces of their natural colours by the spirit in which they had been stored.

Transverse sections taken by hand were employed as a means of assigning many of the specimens to their position. This method was found extremely valuable for rapidly sorting individuals which were so contracted, or of such nondescript external appearance, as to be inseparable by mere inspection. The sections were lightly stained with Paracarmine or Picrocarmine, and rapidly differentiated, dehydrated, cleared (preferably in Xylol) and mounted in Balsam. In the cases where serial sections were made, the best results were obtained by staining on the slide with Hæmalum, or with Delafield's Hæmatoxylin followed by Eosin.

Creosote was found useful in clearing some preparations, such as the proboscis of

the Amphiporidae, in order to see details of structure without making permanent mounts.

The following Table gives a conspectus of the various collecting stations, and the species of Nemertinea collected at each station. The numbers in the left-hand column correspond with the numbers in thick type in the general "List of Collecting Stations" of the Expedition (Vol. II., pp. 1-12):—

Station No.	Position.	Nature of Bottom.	Depth (in fathoms and mètres).	Species.
91	From Summit, Great King, Three Kings Islands, S. 10° W., 25 miles (New Zealand)	Rock.	300 fms. (548 m.)	{ <i>Baseodiscus giardii</i> . { <i>Lineus</i> , sp. "B."
134	Spirits Bay, near North Cape, New Zealand.	Shelly.	11-20 fms. (20-37 m.)	<i>Lineus</i> , sp. "A."
220	Off Cape Adare, mouth of Robertson's Bay (Antarctic).	Shingle.	45-50 fms. (82-92 m.)	{ <i>Amphiporus moseleyi</i> . { <i>A. multihastatus</i> . { <i>Prostoma unilineatum</i> . { <i>Lineus corrugatus</i> . { <i>L. scotti</i> .
294	Ross Sea, Lat. 74° 25' S., Long. 179° 3' E.	(?)	158 fms. (289 m.)	{ <i>Amphiporus moseleyi</i> . { <i>Lineus corrugatus</i> . { <i>L. scotti</i> .
314	5 miles N. of Inaccessible Island, McMurdo Sound (Antarctic).	Mud.	222-241 fms. (406-441 m.)	{ <i>Baseodiscus antarcticus</i> . { <i>Lineus scotti</i> .
316	Off Glacier Tongue, about 8 miles N. of Hut Point, McMurdo Sound.	Undecomposed animal remains and mud.	190-250 fms. (348-457 m.)	{ <i>Amphiporus multihastatus</i> . { <i>Lineus corrugatus</i> . { <i>L. scotti</i> .
331	Off Cape Bird Peninsula, entrance to McMurdo Sound.	Mud.	250 fms. (457 m.)	{ <i>Amphiporus multihastatus</i> . { <i>Lineus corrugatus</i> . { <i>L. scotti</i> .
338	McMurdo Sound, Lat. 77° 13' S., Long. 164° 18' E.	"	207 fms. (379 m.)	{ <i>Lineus corrugatus</i> . { <i>L. scotti</i> .
339	Entrance to McMurdo Sound, Lat. 77° 5' S., Long. 164° 17' E.	"	140 fms. (256 m.)	{ <i>Amphiporus moseleyi</i> . { <i>Lineus corrugatus</i> . { <i>L. scotti</i> . { ? <i>Cerebratulus</i> , sp., juv.
340	Ross Sea, Lat. 76° 56' S., Long. 164° 12' E.	"	160 fms. (293 m.)	{ <i>Lineus corrugatus</i> . { <i>L. scotti</i> .
355	McMurdo Sound, Lat. 77° 46' S., Long. 166° 8' E.	(?)	300 fms. (548 m.)	{ <i>Baseodiscus antarcticus</i> . { <i>Lineus scotti</i> .
356	Off Granite Harbour, entrance to McMurdo Sound.	Mud.	50 fms. (92 m.)	{ <i>Amphiporus multihastatus</i> . { <i>Lineus corrugatus</i> .

II.—SYSTEMATIC AND MORPHOLOGICAL.

ORDER METANEMERTINI.

FAM. AMPHIPORIDÆ.

Amphiporus, Ehrenberg, 1831.1. *Amphiporus moseleyi*, Hubrecht.

Amphiporus moseleyi, Hubrecht, 1887, pp. 20–22 ; Pl. I, figs. 20, 21 ; Pl. IX, figs. 4, 7–9 ; Pl. X, fig. 3 ; Pl. XV, figs. 11, 12, 20.

Stations 220, 294, 339 : 45–158 fathoms.

The collection contains three small specimens and various fragments, including pieces of the proboscis, which I assign to this species, not, however, without some hesitation. The material being so scanty, and the specimens not attaining to the large size of the types in the "Challenger" collection, though some of them are sexually mature, it may be questioned whether we are not here dealing with a new form. But on comparing the details of the proboscis-armature, and hand-sections taken through the whole animal, with the "Challenger" preparations and figures of this species, the resemblances are so great, and the differences so slight, that I do not feel justified in making a specific distinction.

With so small a number of specimens at my disposal, I was unable to cut a series of sections, and have therefore no important contribution to make to the anatomy of the species. It may be remarked, however, that in the various transverse sections taken by hand, chiefly in the middle or posterior region of the body, the lateral nerve-stems do not appear to be situated quite so far dorsally as in the type material. Hubrecht, indeed, lays particular emphasis on the point that the nerve-stems lie *above* the lateral gut-cæca in *A. moseleyi*, and notes this as one of the characteristic features of the species. In the examples now under consideration the nerves do, apparently, lie at some distance from the lateral margin of the body, and nearer to the dorsal than the ventral side, but they are not entirely dorsal to the gut-cæca, parts of which extend outwards both above and below them, and may be said to envelope them, as it were, on three sides. This slight discrepancy may, of course, be due merely to different states of contraction, or to a difference in the level at which the sections were cut.

The nerve-layer of the proboscis, as I find is the case in the "Challenger" material, contains fourteen longitudinal nerves.

The genital organs are also arranged as stated in Hubrecht's account.

The only other point specially observed was the great development, in some specimens, of muscle-bundles running through the gelatinous parenchyme in a dorso-ventral direction. These muscles pass through the longitudinal muscle-layer, and are connected with the circular muscle-layer dorsally and ventrally.

2. *Amphiporus multihastatus*, Joubin. (Pl. I, figs. 1, 2, 5, 7, 9.)

Amphiporus multihastatus [Punnett (*in litt.*)], Joubin, 1910, pp. 11-12; Text-figs. 15, 16; Pl. I, figs. 7, 8.

Stations 220, 316, 331, 356: 45-250 fathoms.

This species appears to be tolerably abundant in and near McMurdo Sound. It was first recorded from Cape Adare, in the "Southern Cross" collection, and some of the "Terra Nova" material comes from the same locality. The collection contains thirteen specimens and some fragments belonging to this species. As it has been possible to cut some serial sections, and to examine the proboscis carefully, a few points in the structure of the species, which have not previously been described, may now be noticed, and a few measurements given.

EXTERNAL FEATURES.

The largest specimens measure about 5 cm. in length. Their thickness, according to the state of contraction, is very variable.

The alimentary canal and proboscis-sheath have a common opening on the head, in the form of a median vertical slit (Pl. I, fig. 2, M.). The external openings of the cerebral organs are in the form of crescentic slits, mainly transverse in direction (Pl. I, fig. 2, C.S.) Numerous eyes were found to be present; they are situated rather deep in the substance of the head, and are arranged in two lateral patches (Pl. I, fig. 1, E.).

INTERNAL ANATOMY.

Alimentary Canal.—The œsophagus is at first (in the region of the brain) very narrow. Soon, however, it expands into a voluminous stomach, with much folded walls. This is succeeded again by a narrower pyloric canal (Pl. I, fig. 5, Pyl.) which opens into the mid-gut at about 4 mm. (in a spirit specimen, as calculated from serial sections) from the tip of the head. There is a large cæcum (Pl. I, fig. 5, Cæc.) extending forwards from this point, ventrally to the pyloric canal, as far as the posterior end of the folded stomach, with which it appears to be in close contact. This cæcum sends out numerous lateral pockets (Pl. I, fig. 5, L.P.), which curve upwards within the muscles of the body-wall.

Proboscis.—The most striking feature of the proboscis in this species, as M. Joubin notices, is its very great thickness in proportion to the animal's body. Its anterior portion is exceedingly muscular, and its diameter is about equal to half that

of the body (Pl. I, fig. 5, Pr.). The nerve-layer of this portion of the organ contains sixteen longitudinal nerves.

The armature of the proboscis (Pl. I, fig. 7) is quite distinctive. The stylets are of a blunter and stouter shape than is usual in the genus, and are particularly broad at the base. The functional stylet measures 0.28 mm.—0.40 mm. in length, and in width, at the point of attachment, 0.12 mm.—0.22 mm. The basis of the functional stylet is also very broad and stout, and is of a somewhat triangular outline. It measures 0.70 mm.—1.3 mm. in length, and 0.4 mm.—0.8 mm. in width at its thickest part, which is posterior.

The reserve stylets are contained in twenty-eight or thirty pockets, arranged in a circle round the bulbous expansion of the proboscis (Pl. I, fig. 7). Each pocket contains one, or at most two, stylets.

Body-wall.—The external epithelium stands on a comparatively thick basement-membrane (Pl. I, figs. 5 and 9, B.M.). The circular muscle-layer is not very thick, but the longitudinal layer (Pl. I, figs. 5 and 9, L.M.) is well-developed, and about equal in thickness to the external epithelium and basement-membrane together.

Cephalic Organs.—Each of the crescentic apertures leads into a cavity which is wide at first, but soon becomes a narrower tube, circular in section, running backwards and inwards to come into connection with the anterior part of the brain. The inner end of each organ is surrounded by the usual ganglionic and glandular structures.

Genital Organs.—In both sexes the gonads are arranged in a manner very similar to that of *A. moseleyi*; *i.e.*, they are distributed round the inside of the body-wall, so that several may be seen in the same transverse section (Pl. I, fig. 9, G.), and without any definite alternation with the gut-cæca. Their ducts open, for the most part, at the sides of the body, but towards the hinder end, where the genital sacs are more numerous, some of the openings are dorsal and ventral.

FAM. PROSTOMATIDÆ.

Prostoma, Ant. Dugès, 1828. [= *Tetrastemma*, Ehrenberg, 1831.]

3. *Prostoma unilineatum* (Joubin). (Pl. I, figs. 3, 8. Text-figs. 1–2.)

Tetrastemma unilineatum [Punnett (*in litt.*)], Joubin, 1910, p. 12; Pl. I, fig. 9.

Stations 220, 339 : 45–140 fathoms.

Of this pretty little species there are nine examples in the present collection.* The type specimens in the "Southern Cross" collection are in poor condition, but there can be little doubt of the determination of these individuals. One of them (Pl. I, fig. 3)

* At the time of studying the material, only two specimens were available. Seven more very small individuals were subsequently sorted out from among dredged material from Station 220.

is somewhat larger than the type specimens, the body measuring 8 mm. in length, and 3 mm. from side to side at the widest part, which is about the middle. The animal tapers towards the head and tail. The dorsal surface is convex, the ventral surface concave. The proboscis was extruded to a distance of 3 mm., but is now broken off, and a microscopic preparation has been made of it to show the armature.

Several of the specimens are very minute, measuring only about 2 mm. in length.

The coloration (in spirit) is as follows: the dorsal side is of a yellowish flesh-colour, with a distinct reddish-brown pigmented median stripe; the ventral side is of a pale ochreous yellow.

The four large eyes have been made out by clearing in creosote. The two on either side lie close together, one behind the other. (Text-fig. 1.)

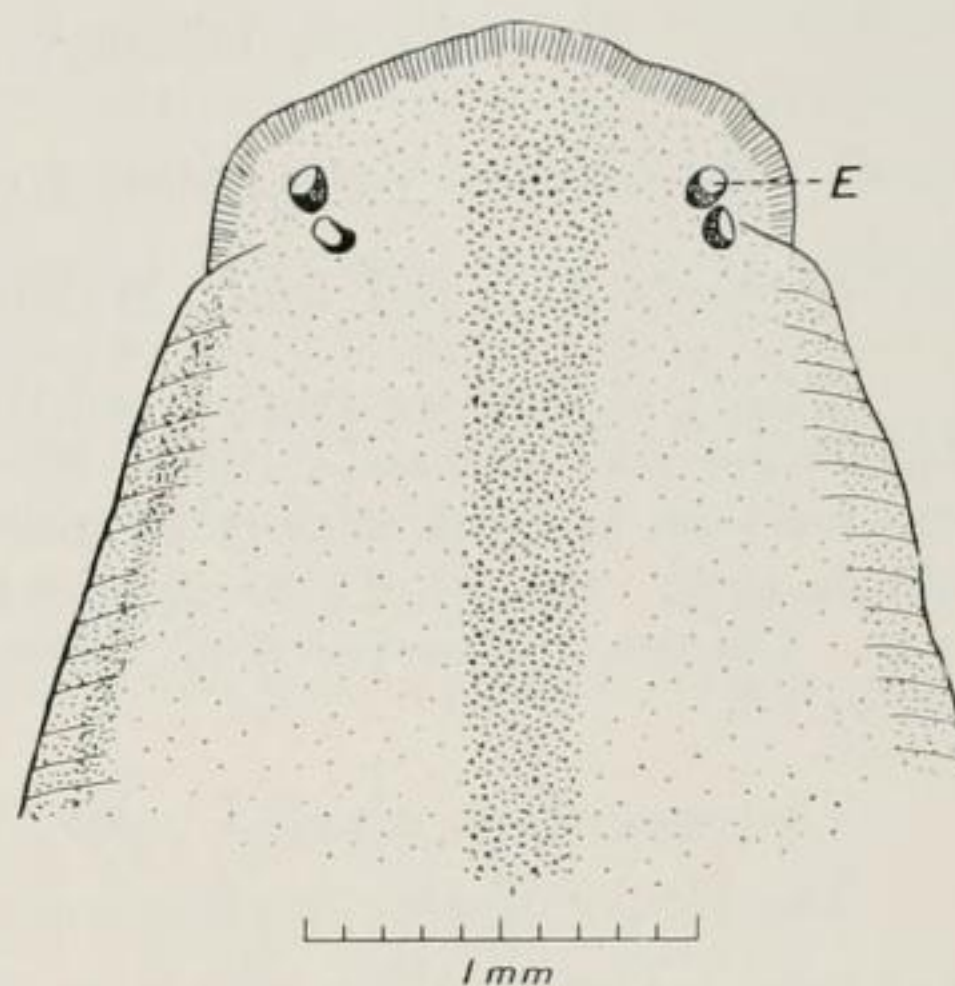


FIG. 1.—*Prostoma unilineatum*: dorsal view of the anterior end, magnified, showing the eyes (E.)

INTERNAL ANATOMY.

The anatomy has not been fully worked out, as serial sections have not been cut. A few transverse sections taken by hand reveal the following characters:

Body-wall.—The external epithelium (Pl. I, fig. 8, Ep.) consists of very tall cells, interspersed with many unicellular glands and their secretions, which are seen escaping to the exterior. It rests on a thin basement-membrane, which separates it from the circular muscle-layer. Both this latter layer and the succeeding longitudinal layer are thin and but feebly developed.

Ova.—The largest specimen is a female, and the entire space within the longitudinal body-muscles, where not occupied by the gut and its lateral diverticula, or by the proboscis-sheath, is filled with eggs of relatively enormous size (Pl. I, fig. 8, Ov.), measuring about 0.4 mm. in diameter. Their nuclei are also large (0.08 mm.—0.1 mm. in diameter) and contain many refringent globules.

Proboscis-sheath and Proboscis.—The proboscis-sheath is proportionally large, and is supplied with strong circular muscles.

The proboscis is relatively very stout, but its armature is minute, in accordance with the small size of the whole animal. The form of the central stylet and its basis is represented in text-fig. 2. The basis measures 0.15 mm. in length. There are two pockets containing reserve stylets to the number of about four in each.

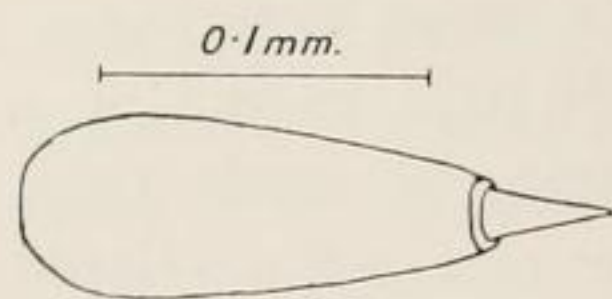


FIG. 2.—*Prostoma unilineatum*: the functional stylet of the proboscis, and its basis, highly magnified.

ORDER HETERONEMERTINI.

FAM. BASEODISCIDÆ.

Baseodiscus, Diesing, 1850. [= *Eupolia*, Hubrecht, 1887.]

4. *Baseodiscus antarcticus*, sp. n. (Pl. I, figs. 4, 6.)

Stations 314 and 355: McMurdo Sound, 222-300 fathoms.

A fairly distinct constriction immediately behind the mouth, when the head is not retracted. Cephalic grooves lateral and vertical. Mouth small and circular. Primary basement-membrane of cutis deep, but loose, and with many radial muscle-fibres. A well-developed layer of gland-cells in connection with the cutis. Bundles of fibres in outer longitudinal muscle-layer of body separated by much gelatinous tissue. Circular muscle-layer thin. Walls of gut not folded. Proboscis slender, and proboscis-sheath thin-walled.

Two specimens which I refer to this form occur in the collection.

The larger of the two measures 5.5 cm. in length, and has a maximum thickness of 9 mm. The smaller, which is apparently a young female, measures only 2 cm. in length and 5 mm. in thickness.

There is no trace of colour or markings upon either individual.

EXTERNAL FEATURES.

In the small specimen the characters of the head (Pl. I, fig. 4) can be fairly well made out; it is marked off from the body by a moderately distinct constriction, immediately behind the mouth. The proboscis-pore (P.P.) is a well-marked vertical slit just below the apex of the head. The shallow cephalic grooves (G.) are lateral and vertical, and apparently do not form a complete ring. The mouth (M.) is small and circular, with regularly wrinkled margin.

In the larger example the head is much retracted, and little of these features can be made out with certainty.

INTERNAL ANATOMY.

A small piece was taken from about the middle of the body of the small specimen, and cut into transverse sections (Pl. I, fig. 6). These reveal the following features:—

The external epithelium of the body (Ep.) consists of tall cells, resting on a secondary basement-membrane (B.M²), succeeded by two thin layers of muscle-fibres, an outer circular and an inner longitudinal. Beneath the latter is a well-developed layer (Gl.) of large glandular cells. Next comes the thick primary basement-membrane (B.M¹), consisting of a rather loose connective tissue, through which many bundles of muscle-fibres pass outward radially.

The outer layer of longitudinal body-muscles (L.M²) comes next in order. The

bundles of fibres belonging to this layer are somewhat scattered, and are embedded in a considerable amount of gelatinous and solid-looking connective tissue.

The circular muscle-layer (C.M.) is thin. Between it and the outer longitudinal muscles lie the large lateral nerve-stems (L.N.).

The inner layer of longitudinal muscles (L.M^l.) is comparatively thick and dense. Beneath it lie the proboscis-sheath (P.S.), the gut, and a certain amount of loose connective tissue. In this connective tissue, between the muscles and the gut, there are numerous large spaces, some of which are probably blood-sinuses, but others appear to be the gonadial sacs. The former are situated dorsally and ventrally, the latter at the sides. In the anterior part of the series of sections these gonadial spaces are empty, but more posteriorly ova are beginning to be developed from their walls. The ova always appear on that side of the sac which is towards the exterior. The sex of the larger specimen was not determined, and I am unable to give any particulars as to the arrangement of the gonads in the male.

The gut (Pl. I, fig. 6, Int.) is simple and spacious, and its wall is not folded.

The proboscis is feebly developed, and its sheath is thin-walled, and not abundantly provided with muscles.

With such scanty material available, nothing further can be said at present of the anatomy of this species. Its chief interest lies in the fact that it is the only member of the genus as yet recorded from truly Antarctic waters, unless we accept *Eupolia punnetti* as a "good" species. I shall further state my views with regard to this question under the heading of *Lineus corrugatus*; but I may be permitted to remark here that I can see no reason for referring that form to the genus *Eupolia* (or *Baseodiscus*). If this view be correct, the present species will be the only one, I believe, hitherto recorded from a latitude further south than 42°.

5. *Baseodiscus giardii* (Hubr.)

Eupolia giardii [McIntosh (*in litt.*)], Hubrecht, 1887, pp. 11-13; Pl. I, figs. 7-9; Pl. V; Pl. VI, figs. 4-11; Pl. VII, figs. 4, 5, 8; Pl. X, fig. 6; Pl. XI, fig. 12.

Station 91: 300 fathoms.

A single specimen taken near Three Kings Islands, New Zealand, appears to belong, in all probability, to this species. It measures about 6 cm. in length, and has a thickness of 6 mm. The head-end tapers somewhat, and shows a faint surrounding groove, as described and figured by Hubrecht. The tail is conically pointed, and thicker than the head.

The specimen is a female.

No traces of colour can now be made out.

FAM. LINEIDÆ.

SUB-FAM. LINEINÆ.

Lineus, Sowerby, 1806.6. *Lineus corrugatus*, M'Int. (Text-figs. 3-4.)

Lineus corrugatus, M'Intosh, 1876, pp. 322-323. M'Intosh, 1879, p. 262; Pl. XV, figs. 17, 18. Studer, 1879, p. 123. Bürger, 1904 (1), pp. 96-97. Joubin, 1910, pp. 2-8; Text-figs. 1-10; Pl. I, figs. 1-5.

Cerebratulus corrugatus, Hubrecht, 1887, pp. 41-43; Pl. I, fig. 17; Pl. XI, fig. 9; Pl. XII, figs. 3, 4; Pl. XIII, figs. 1-6; Pl. XIV, figs. 2-4. Joubin, 1908, p. 6.

? *Cerebratulus charcoti*, Joubin, 1905 (1), pp. 315-318, and text-figure. Joubin, 1905 (2), p. 432. Joubin, 1908, pp. 2-6; Fig. 1.

Lineus hanseni, Joubin, 1910, pp. 8-9; Fig. 11.

Eupolia punnetti, Joubin, 1910, pp. 9-10; Figs. 13, 14.

Stations 220, 294, 316, 331, 338, 339, 340, 356: 45-250 fathoms; Station 324, McMurdo Sound, on shore.

This fine species forms the bulk of the present collection, having been captured at nearly all the dredging stations in the Ross Sea and McMurdo Sound, where it is evidently very abundant.

The best account of this form is still that of Hubrecht (1887) in the report on the "Challenger" collection. His description and figures of the histological details of the body-wall in particular are most accurate and complete.

The original description of the species by M'Intosh (1876) is very brief, and may be quoted here in full:—

"Body (in spirit) flattened, rather abruptly pointed anteriorly, and more gradually posteriorly. The œsophageal region is marked externally by a series of prominent and somewhat regular rugæ, which sweep from the mouth dorsally and ventrally; so that the dorsal view recalls that observed in *Arion ater*."

"Colour dark olive throughout, with the exception of a white band, which crosses the anterior border of the snout, and passes backward to the posterior third of the lateral fissure, where it bends dorsally and terminates."

"The special characters are the very large mouth, with the prominent rugæ, which show that the animal probably possesses unusual powers of œsophageal protrusion—a supposition borne out by the great development of the external circular muscular fibres and the succeeding longitudinal coat of the organ. The internal glandular lining is also very firm. The outer layers of the proboscis correspond with the type in the Lineidæ; but the internal longitudinal layer is largely developed."

In size the specimens in the present collection vary very greatly; the smallest of the young individuals measure about 6 cm. in length, and are generally coiled ventrally in a spiral when in spirit. The largest specimen is 65 cm. in length; this example was found "washed up on Hut beach, Feb. 28th, 1911," and is in a

very expanded condition. Another measures 52 cm., and there are several of nearly this size.

The colours of the large examples are no longer distinguishable—some are perfectly white, while others have apparently been discoloured by the spirit in which they were kept.* The young, however, still show the characteristic markings mentioned in M'Intosh's description. The ground colour is now (in spirit) a dirty reddish brown above, somewhat paler below, and with slight indications of a paler longitudinal stripe on either side in some cases. The cephalic slits are edged with white, and a white streak passes dorsally from near the hinder end of each slit, forming a nearly complete band across the head.

In some of the large examples the head is exceedingly elongate, the mouth measuring 23 mm. (in the "Hut beach" specimen 30 mm.) in length, and the cephalic slits about 6 mm.

One specimen, measuring about 50 cm. in length, exhibits a very marked flattening of the posterior end, which led me to question whether this was not of a different species from the rest. It is, indeed, remarkably similar to the form described by Joubin (1908) as *Cerebratulus charcoti*. By means of sections, however, I have satisfied myself that there is no ground for believing that it is not an example of *L. corrugatus*. It is a male, and in the flattened posterior portion the testes may be seen in section, disposed peripherally within the muscles of the body-wall. The various layers of the body-wall are much reduced in thickness in this region, and the muscle-layers in particular appear at this point to be very weak. Hence the probable explanation of the flattening (which is seen in varying degrees in other specimens also†) is that at the time of sexual maturity the body-wall becomes reduced in thickness, and less strongly muscular, in order to provide more room for the sexual products which are ripening within. The natural result of this process would be that the weakened portion would participate less fully in the muscular contraction which takes place under the action of a fixing reagent, and, if already flattened, would remain so.

I have been led, during my investigation of this species, to entertain doubts as to the validity of certain other species from Antarctic waters, and it is appropriate here to make some reference to them. While working on the "Terra Nova" collection I have had at my disposal the types of the "Challenger," "Discovery," and "Southern

* The following note on their colours during life has been submitted to me by Mr. D. G. Lillie:—"The long *Lineus*-like specimens obtained in the Antarctic were of a purplish light red or terra-cotta colour on the dorsal side, and a yellowish-creamy white on the under surface. The colouring was very much alike in all the larger specimens obtained." He adds, with regard to this species, that "they had great power of elongating and contracting their bodies."

† The "Hut beach" specimen is flattened throughout its entire length, but it is probable that this individual was in a moribund condition when collected, and I do not attach any importance to its exceptional appearance.

Cross" collections. Among them there are good series of sections of *Lineus corrugatus*, *Lineus hanseni*, and *Eupolia punnetti*. I have worked through all the series, paying particular attention to those (twelve in all) which were taken through the heads of the worms, and which show the arrangement of the brain, cephalic organs, and blood-spaces in that region. On carefully comparing all these series together, and also with the "Terra Nova" specimens of *L. corrugatus*, I can find no reason, either in the grosser anatomy, or even in the finer details of histology, for regarding any of them as distinct species, and I therefore consider them all synonymous with that originally described by McIntosh (1876).

One of the most characteristic features of *Lineus corrugatus*, as has been noticed by M. Joubin (1910), is the arrangement of the large blood-sinuses in the head. I have paid special attention to this system in all the species mentioned, and find it in every instance identical. Such slight apparent differences as there are, are evidently the result of different states of contraction, and are in no way due to any variation in structure. At the point where the blood-sinus traverses the nerve-collar it becomes so compressed in some specimens as to be almost obliterated, but it can nevertheless be traced, and shown to go through essentially the same changes at different levels, in all the specimens examined, and in all the "species" above named.

As my conception of this blood-sinus and its transformations differs somewhat in details from that of M. Joubin (1910), and as it is an important feature of the species, I have prepared a series of diagrams illustrating its appearance as it is traced back through any series of transverse sections, commencing with the snout of the animal. These diagrams were all outlined with the camera lucida, though they were not all taken from the same series of sections, as the vessels in a given region were better displayed sometimes in one specimen, sometimes in another, according to its state of contraction. In all, however, they could be traced with more or less ease, and reduced to the same plan.

Starting, then, with the tip of the animal's head, we find a single blood-sinus occupying a median position dorsal to the rhynchodæum (Fig. 3, A.). This sinus soon widens out (Fig. 3, B.), and becomes divided into two lateral spaces by the development of a partition from the dorsal side of the rhynchodæum to the opposite wall of the sinus (Fig. 3, C.). The blood-spaces, a little behind this point, come to embrace the rhynchodæum between them, each being of a crescentic shape in transverse section (Fig. 3, D.). This condition remains constant until the region of the brain begins to be reached. The connective and muscular tissues in the centre now begin to increase at the expense of the blood-spaces, which become very attenuated (Fig. 3, E.-H.). This development of muscular tissue is the first indication of the proboscis-sheath proper, whose muscles are at this point continuous with those of the proboscis itself.

A space, or spaces, now begin to appear in the central tissue. These represent the beginning of the lumen of the proboscis-sheath, which soon completely surrounds

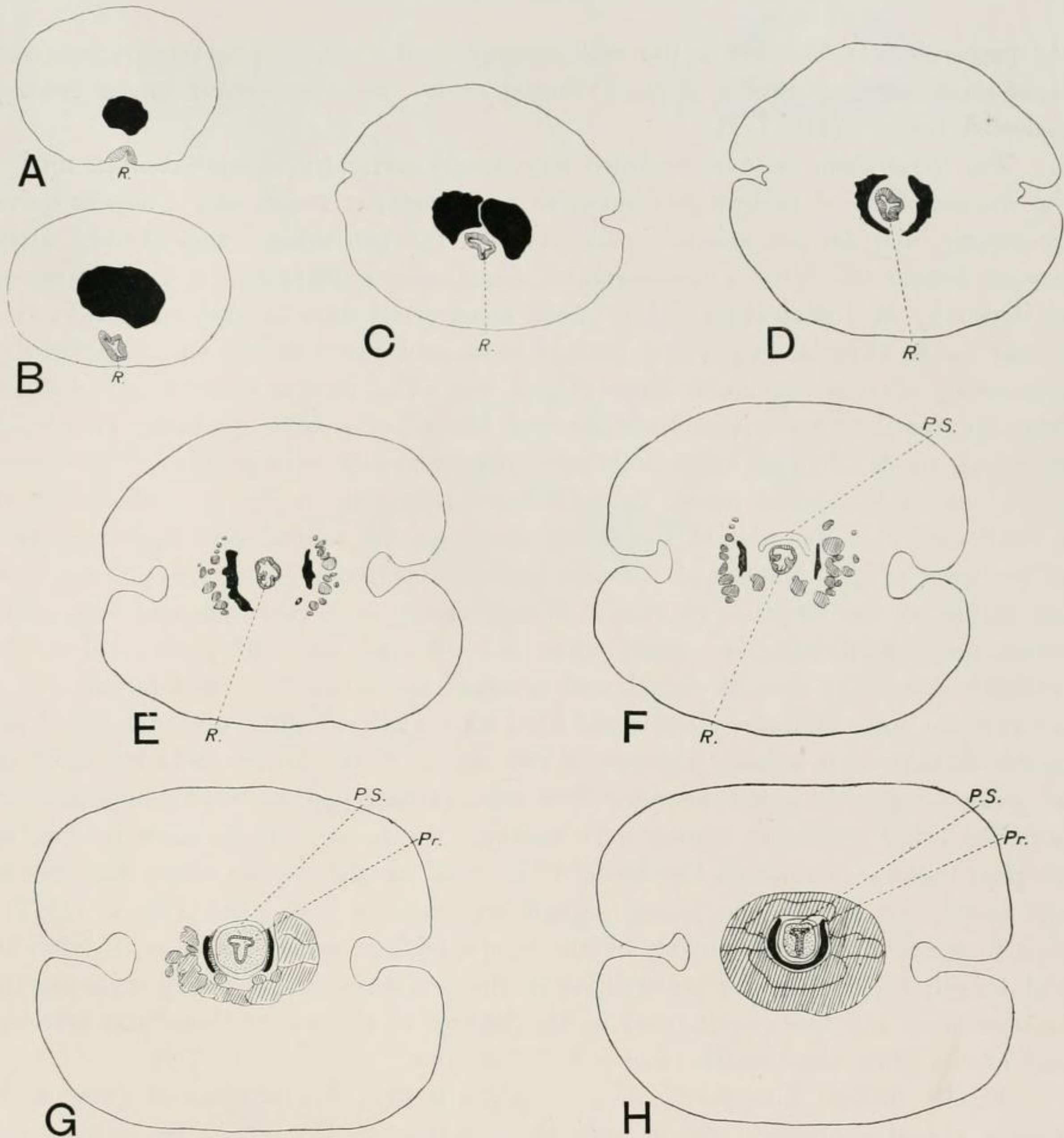


FIG. 3.—*Lineus corrugatus*.—Diagrams of a series of transverse sections, illustrating the vascular system, which has been represented in solid black. The brain and nervous structures are hatched. *Pr.*, proboscis; *P.S.*, cavity of proboscis-sheath; *R.*, rhynchodæum, seen opening to the exterior in the first diagram (A).

- A—Shows the median blood-sinus in the snout, lying dorsally to the proboscis-pore (*R.*). Blood-sinus represented in solid black.
- B—The proboscis-pore has passed into the rhynchodæum (*R.*), and the blood-sinus is of wider calibre.
- C—The blood-sinus becomes divided into two by a partition of connective tissue developing on the dorsal side.
- D—There is now a complete wall of connective and muscular tissue dividing the two blood-spaces, and enclosing the rhynchodæum.
- E—Nerves from the anterior part of the brain are appearing laterally, and the central tissue is encroaching more and more upon the blood-spaces, so as to reduce them in size.
- F—The central muscular tissue begins to show spaces—the beginning of the cavity of the proboscis-sheath (*P.S.*). Blood-spaces still further reduced.
- G—The cavity of the proboscis-sheath is now seen completely surrounding the proboscis (*Pr.*), and separated by a thin wall from the blood-space on either side. The blood-spaces are pressed between the brain and the proboscis-sheath, so as to be very narrow at this point.
- H—The blood-spaces have coalesced ventrally, so as to form a U-shaped vessel enclosing the proboscis-sheath.

the proboscis. It has only a thin wall ventrally and laterally, separating it from the blood-sinus, which is now a single U-shaped cavity, the two lateral sinuses having coalesced below. (Fig. 3, H.)

The blood-sinus may be regarded as a single cavity throughout, broken up by the encroachment of bridges of connective and muscular tissue, which appear quite irregularly, and are not always symmetrical on the two sides. Immediately after passing behind the brain, a median ventral blood-space is formed for a short distance, as shown by M. Joubin (Fig. 4, A.). This, however, is soon divided again into two lateral spaces (Fig. 4, B.), which become more and more widely separated by the intervening mass of connective tissue (Fig. 4, C.). This median space is quite distinct from the vessel of the proboscis-sheath, and instead of passing gradually into it, as described by M. Joubin, never has any connection with it whatever. This vessel, usually called the dorsal vessel, though clearly belonging to the proboscis-sheath, is a small cavity in the wall of the sheath itself, on the ventral side, appearing first at the level of the hinder part of the brain, and extending, probably, throughout the length of the sheath. Its dorsal wall anteriorly is a very thin and collapsible membrane. Posteriorly the vessel sinks more deeply into the tissues below the proboscis-sheath, so that its dorsal wall becomes much thicker. Not having cut a whole worm into sections (which would be a somewhat extensive undertaking), I am unable to state what actually becomes of this vessel at the hinder end; but so far as my evidence goes it is not, at any rate at the anterior end, in direct communication with the other system of sinuses. To continue the history of the main system, as we pass backwards through the series of sections to the region where the mouth and œsophagus appear, the lateral sinuses, at first few and large (Fig. 4, C.), are seen to spread round the outside of the œsophagus, so as to embrace it laterally and dorsally, except for the interruption of the proboscis-sheath. They subsequently become more and more subdivided by the bridges of connective tissue and muscles, and at the same time smaller and less conspicuous.

Finally, behind the mouth, their condition is that of a network of quite small vessels almost completely surrounding the gut (Fig. 4, D.). They lie between the inner longitudinal body-muscles and the circular muscle-layer which surrounds the gut, and have now acquired a much more definite lining epithelium of their own. They now present, in fact, exactly the appearance described and figured by Hubrecht (1887, Pl. XIII, fig. 6).

One other point may be mentioned in connection with the vascular system, in which I cannot entirely agree with M. Joubin's description (1910). He states that both in *L. corrugatus* and in *L. hanseni* there are certain "orifices" by which the cavity of the rhynchodæum is in communication with that of the blood-sinus in the head. This communication is said not to be direct, but certain "ampullæ" in the thickness of the wall of the rhynchodæum are said to communicate through a kind of spongy tissue with the blood-sinus, being at their inner ends in direct

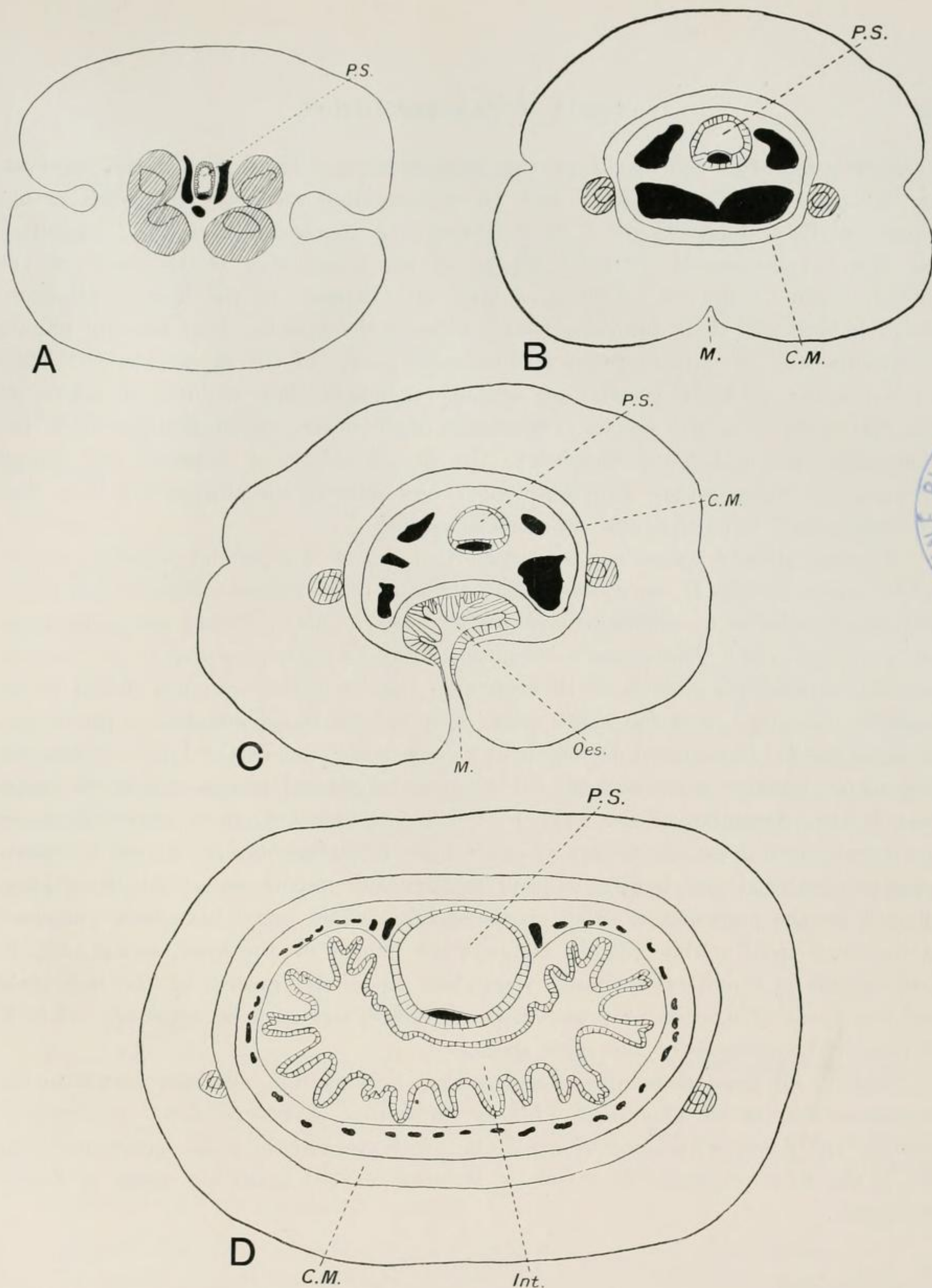


FIG. 4.—*Lineus corrugatus*.—Continuation of the series of diagrams illustrating the vascular system (solid black). *C.M.*, circular muscles; *Int.*, intestine; *M.*, mouth; *Oes.*, oesophagus; *P.S.*, cavity of proboscis-sheath.

- A—Bridges of connective tissue and muscles begin to cross the blood-space irregularly, breaking it up into a network of intercommunicating vessels. A small blood-vessel, with very thin dorsal wall, is now appearing in the wall of the proboscis-sheath, on the ventral side. (The proboscis is no longer seen, having been torn out in this specimen.)
- B—A median ventral blood-space has appeared temporarily, but is already being encroached upon by the connective tissue, and separated into two lateral spaces.
- C—The branches of the blood-space are becoming widely separated, and spreading round to embrace the walls of the oesophagus and mouth, which have now appeared.
- D—The final condition of the blood-space with its network of vessels. These now lie below the inner layer of longitudinal muscles, and completely surround the intestine. The blood-vessel of the proboscis-sheath is still seen, its dorsal wall being an exceedingly thin membrane (exaggerated in thickness in the drawing).

communication with the lumen of the rhynchodæum. The figures given, however, are not altogether convincing; and on re-examining the material (which is not conspicuously well preserved), I have formed the conclusion that the "ampullæ" are to a certain extent artificial results of the contraction of the wall of the rhynchodæum. They are, in fact, a kind of "hernia" of the lining epithelium, which is here and there pushed outwards between the muscles, thus forming minute diverticula still in communication with the main cavity of the rhynchodæum. They do not occur in all the series of sections examined, and are not, therefore, an essential feature of the species. Moreover, their outer communications with the blood-sinus are, I believe, imaginary. In no case have I detected any actual opening, and though they sometimes come very near to the surface, I believe that this appearance is entirely due to artificial causes.

Having already stated my conviction that *Lineus hanseni* and *Eupolia punnetti* are synonymous with *L. corrugatus*, I may perhaps be permitted further to add that I feel some doubt as to whether *Cerebratulus charcoti*, Joubin, should not come under the same category. The author's description (1908) does not appear to me to show any very satisfactory grounds for its separation; no description or figures of its internal anatomy are given, and the main points upon which the distinction of the species is based are (1) the marked flattening of the posterior end of the body; (2) certain very vague features of colour; and (3) the great length and attenuation of the head. Now (1) the flattening of the body, as I have attempted to show above, occurs in specimens which I cannot regard as other than *L. corrugatus*; (2) colour, in spirit-preserved material, can hardly be said to have any importance at all, being often affected by the pigments of other specimens, &c., which may have been immersed in the same spirit; while (3) the comparative length of the head, mouth, &c., in these worms is a matter obviously dependent upon the growth of the individual and the mode of fixation or preservation employed, and may be extremely variable in preserved specimens of the same species.

Taking all these facts into consideration, I think the evidence points to the conclusion that in all four cases (*Lineus corrugatus*, *Lineus hanseni*, *Cerebratulus charcoti*, and *Eupolia punnetti*) we are dealing with one and the same species, and that this is the form originally described by McIntosh (1876) under the name of *Lineus corrugatus*.

DISTRIBUTION.

By the inclusion of the several species above-mentioned in the synonymy of *L. corrugatus*, the range of the latter is seen to extend to the western as well as the eastern side of the subantarctic regions. The specimens determined by M. Joubin as *Cerebratulus corrugatus* and *C. charcoti* came from Booth-Wandel Island. I have also to add that some immature specimens brought from Cumberland Bay, South Georgia, by the late Major G. E. H. Barrett-Hamilton's Expedition, 1913-1914, belong, in

my opinion, to the same species. Combining, therefore, all these records, we have the following:—

Locality.	Collection.	Approximate Latitude.	Approximate Longitude.
Cape Adare	{“Southern Cross,” }“Terra Nova.”	72° S.	170° E.
McMurdo Sound	{“Discovery,” }“Terra Nova.”	77° S.	165° E.
Heard Island	“Challenger.”	53° S.	74° E.
Kerguelen	{British Transit-of-Venus Exp., }“Challenger.”	50° S.	70° E.
Booth-Wandel Island	Charcot's 1st Exp.	65° S.	66° W.
South Georgia	{Major Barrett-Hamilton's Exp., } 1913–1914.	54° S.	37° W.

These localities lie in a fairly complete circle, between the approximate latitudes of 50° S. and 77° S., and it appears that we are dealing with a single common species which extends completely round the subantarctic region. It is, perhaps, somewhat remarkable that the species, occurring as near as South Georgia, should not have been recorded from the Strait of Magellan, which lies well within its range of latitude; and possibly sooner or later it will be found there. Its northern range, however, with the exception of Kerguelen and Heard Island, appears to lie within the extreme limits of the pack-ice.

7. *Lineus scotti*, sp. n. (Pl. II, figs 1–6.)

Skin smooth. Head blunt and rounded. Mouth rather short. A transverse groove encircling the head behind the cephalic slits. The latter are deep, and communicate with the brain only at their hinder ends. Primary basement-membrane of cutis lacking. Glandular cells in epithelium with a brownish secretion. Outer longitudinal muscle-layer very dense and thick. Proboscis with four longitudinal nerves. Its circular muscle-fibres form dorsal and ventral crosses. Cerebral organs large, projecting into lateral head-sinuses.

Length up to 10·7 cm. (probably often greater).

Stations 220, 294, 314, 316, 331, 338, 339, 340, 355 : 45–300 fathoms.

The species seems to occur together with *L. corrugatus* in nearly every case.

A number of specimens of this *Lineus*, which is clearly distinct from *L. corrugatus*, occur in the collection. I have named this species in honour of the lamented Commander of the Expedition. The two forms, when in spirit, are generally readily separated by mere external inspection, though by this means some specimens of *L. scotti* might easily be taken for immature individuals of *L. corrugatus* which had become decolorised.

EXTERNAL FEATURES.

The chief points in the external appearance of *L. scotti* which serve to distinguish it from *L. corrugatus* are as follows:—

The skin is comparatively smooth, and not thrown into marked wrinkles and furrows.

The head is usually blunt and rounded in front. The snout is, however, evidently capable of some extension, as in a small number of individuals it has been fixed in a more tapering form.

The young specimens do not appear to coil up ventrally in a spiral when killed, as do those of *L. corrugatus*.

The mouth (Pl. II, fig. 1) is a longitudinal slit, but not nearly so elongate as in the other species. In the largest individual it measures 5 mm. in length. The lips are thrown into regular folds transversely to the long axis of the mouth.

There is in many cases a more or less well-marked transverse groove behind the cephalic slits. This is especially noticeable on the ventral side (Pl. II, fig. 1), where it runs back in the middle line to meet the anterior end of the mouth, thus forming a V-shaped furrow.

The cephalic slits are very deep and clean-cut, measuring about 4 mm. in length in the largest individuals.

The proboscis-pore (Pl. II, fig. 1) is, as usual, a vertical slit at the tip of the snout, crossing at right angles a slight groove which joins the anterior ends of the cephalic slits.

In length, complete specimens (of which there are few) measure from 2·4 cm. to 10·7 cm. The larger specimens are all fragmentary, and it is impossible to guess at the maximum length probably attained; but this would seem to be certainly very much smaller than that reached by *L. corrugatus*. In thickness, the largest fragment measures about 8 mm. laterally and 6 mm. dorso-ventrally; the other specimens vary greatly in thickness according to their state of contraction.

No traces of the original colours of the species can be made out.

Nearly all the specimens appear to be sexually immature.

INTERNAL ANATOMY.

Body-wall.—The outer epithelium (Pl. II, fig. 3, Ep.) consists of very tall ciliated cells, with numerous smaller interstitial cells at their bases. Between the tall epithelial cells are scattered many large club-shaped cells (Pl. II, fig. 3, Gl.²) full of a refractive yellowish-brown secretion.

Below the epithelium there is a thin but solid-looking basement-membrane (B.M.), scarcely as deep as the epithelium itself. Beneath this again there is a thin layer of circular muscle-fibres (C.M²). A well-developed and conspicuous, deeply-staining layer of large glandular cells (Gl.) succeeds this, resting immediately upon, and being partly

embedded among, the fibres of the outer longitudinal muscle-layer (L.M²). The deep "primary basement membrane," so conspicuous in *L. corrugatus*, separating the glandular layer from the musculature, is entirely absent.

The outer layer of longitudinal muscles (Pl. II, figs. 2, 3, 4, 5, L.M²) is exceedingly thick and well-developed. Its fibres are separated into groups only by slight partitions of connective tissue, so that under a low power of the microscope they appear closely and evenly placed together, and the whole layer has a very solid aspect. Between this layer and the circular muscles there is present the usual nerve-plexus (Pl. II, fig. 2, N.P.), with the two large and well-developed lateral nerve-stems and a small dorsal nerve.

The circular muscle-layer (Pl. II, figs. 2, 4, 5, C.M.), like the outer longitudinal layer, is very stout and solid in appearance. It is succeeded by a comparatively thin inner longitudinal layer (L.M¹). The last two layers together make up a thickness nearly equal to that of the outer longitudinal coat.

Alimentary Canal.—The intestine is U-shaped in transverse section (Pl. II, fig. 2, Int.), and without marked lateral diverticula. It seems to be characteristic of this species that the "crypts," or pockets, in the lining epithelium—at least, in the œsophageal portion of the gut—form very regular and acute angles.

Proboscis-sheath and Proboscis.—The proboscis-sheath is larger in diameter, relatively to the size of the whole animal, than that of *L. corrugatus*. Its lining epithelium rests on (1) a thin basement-membrane, followed by (2) a thin longitudinal coat of muscle-fibres; (3) a thin circular coat of muscles, connected dorsally with the circular musculature of the body-wall; and (4) another coat of longitudinal muscles, which is in reality part of the inner longitudinal coat of the body-wall.

The dorsal blood-vessel (Pl. II, figs. 2, 4, 5, D.V.), or vessel of the rhynchocœle, as it might more descriptively be called, lies, anteriorly, on the inside of the circular muscles of the proboscis-sheath; more posteriorly, it sinks through the circular muscle-layer, and eventually comes to lie below it, among the outer longitudinal muscles. It has very thick walls, as compared with the corresponding vessel in *L. corrugatus*.

The proboscis is thin, and its musculature is not strongly developed. In transverse section (Pl. II, fig. 6) some of the circular muscle-fibres are seen to cross each other dorsally and ventrally (C., C.), and pass outwards to the periphery, as in the common *Cerebratulus marginatus*. Within the circular layer of muscles there is a nervous layer, containing four large longitudinal nerves (N.). There is no inner longitudinal layer of muscles separating this nervous layer from the lining epithelium. The latter is mainly composed of tall glandular cells.

Vascular System.—The blood-sinuses in the head are arranged on a plan similar in essential points to that of *L. corrugatus*, already described; but after the U-shaped sinus has passed behind the dorsal commissure of the brain, its two arms extend dorsally and outwards (Pl. II, fig. 4, B.S.), so as to embrace the dorsal ganglia and

cerebral organs. They then become separated by muscular tissue from the ventral portion of the "U" (Pl. II, fig. 4, V.B.S.), just as in *L. corrugatus*, so that there are for a short distance three apparently distinct spaces. Further back, the system of intercommunicating vessels is not nearly so elaborately developed as in the former species; the blood-spaces round the gut are by no means so distinct or so numerous, the most conspicuous being a pair of longitudinal vessels situated to right and left of the proboscis-sheath, dorsal to the gut (Pl. II, figs. 2 and 5, B.S.). A few smaller and more irregular vessels can be seen laterally and ventrally.

Sense-organs and Nervous System.—There is a minute "frontal organ" at the tip of the snout, and the head is very abundantly supplied with gland-cells, some of which are probably connected with it.

The cephalic slits are very deep and straight-sided. There is very little expansion at the bottom of the furrows, which communicate with the brain only at their hinder ends. On the posterior wall of each slit there is a prominent transverse ridge, containing a groove which leads into the canal of the cerebral organ.

The upper extremity of the dorsal ganglion of the brain on either side ends immediately in front of the cerebral organ. In the anterior and upper part of the dorsal ganglia, the largest or "giant" type (Bürger) of ganglion-cells are extraordinarily well seen, and are of very large size in proportion to the whole brain.

The cerebral organs (Pl. II, fig. 4, C.O.) are well-developed, large, and abundantly supplied with glands. On their inner and dorsal sides they are closely surrounded by the lateral portions of the cephalic blood-sinus.

The lateral nerves, with their investment of ganglionic cells, run out almost at right angles to the long axis of the animal for a considerable distance on leaving the brain (Pl. II, fig. 4, L.N.), and then turn back to run in the usual manner along the sides. They are very stout, and lie somewhat towards the ventral side of the animal (Pl. II, fig. 2, L.N.).

There is a complete plexus of nervous tissue (Pl. II, fig. 2, N.P.) immediately outside the circular muscles of the body-wall, and a small dorsal nerve in this layer, in the middle line, as in *L. corrugatus*.

Genital Organs.—In a female specimen examined, the gonads appear to form a continuous series along either side of the worm (Pl. II, fig. 5, G.). They compress the gut between them, and are not separated from their neighbours by any lateral gut-cæca. The eggs contained in this individual measure about 0·2 mm. in diameter.

I am unable to give any account of the arrangement of the genital organs in the male.

Note :—It may be remarked that there is nothing in my description of this form contradictory to the supposition that it is identical with *Cerebratulus validus*, Bürger, from South Georgia. On the other hand, the description (1893) of the latter species is based upon one specimen only, and is so brief that it would be scarcely possible to determine the species from it, and moreover no figures are given. Hence I have not hesitated to regard the "Terra Nova" material in the light of a new species.

8, 9. *Lineus*, spp. "A" and "B."

"A," Station 134. "B," Station 91.

There remain two specimens, apparently of this genus, from the New Zealand waters, belonging evidently to two distinct species; but as to the determination of these I prefer to reserve judgment. I hesitate to found a new species upon a single specimen, as the description must necessarily be incomplete, and may only lead to confusion. One of these two individuals, which I will call *Lineus* sp. "A," is interesting mainly on account of the following features: The body is slightly flattened, and the head is shaped like an arrow-head, the posterior ends of the cephalic slits projecting considerably at the sides, and the snout tapering to a point. The cephalic slits are 3.5 mm. long. The mouth is small, and measures only slightly over 2 mm. in length. The skin is deeply pigmented, of a rather dark olive-green colour. The pigment-granules are closely crowded together in the thick primary basement-membrane, and in another layer immediately outside the circular muscle-layer of the body-wall. Between these two main layers scattered granules are also seen in the radiating strands of connective tissue among the outer longitudinal muscles. The snout, and the edges of the cephalic slits and mouth, are ochreous, and may perhaps have been red during life. [Length of specimen (tailless), 5 cm.]

SUB-FAM. MICRURINÆ.

Cerebratulus, Renier, 1804.10. ? *Cerebratulus*, sp. (juv.)

Station 339.

There is a single very small specimen in the collection, with a minute tail-like appendage at the posterior end. The total length of the animal is about 7 mm. The skin is transversely wrinkled, and the general colour yellowish, thickly dotted with minute reddish-brown spots of pigment.

The snout is thick and square, and the whole head large in proportion to the body. The cephalic slits measure a little over 1 mm. in length. The mouth is elongate, but not large, and lies behind the cephalic slits.

It is only provisionally that I assign this specimen to the genus *Cerebratulus*, and I regard it as probably a very young individual.

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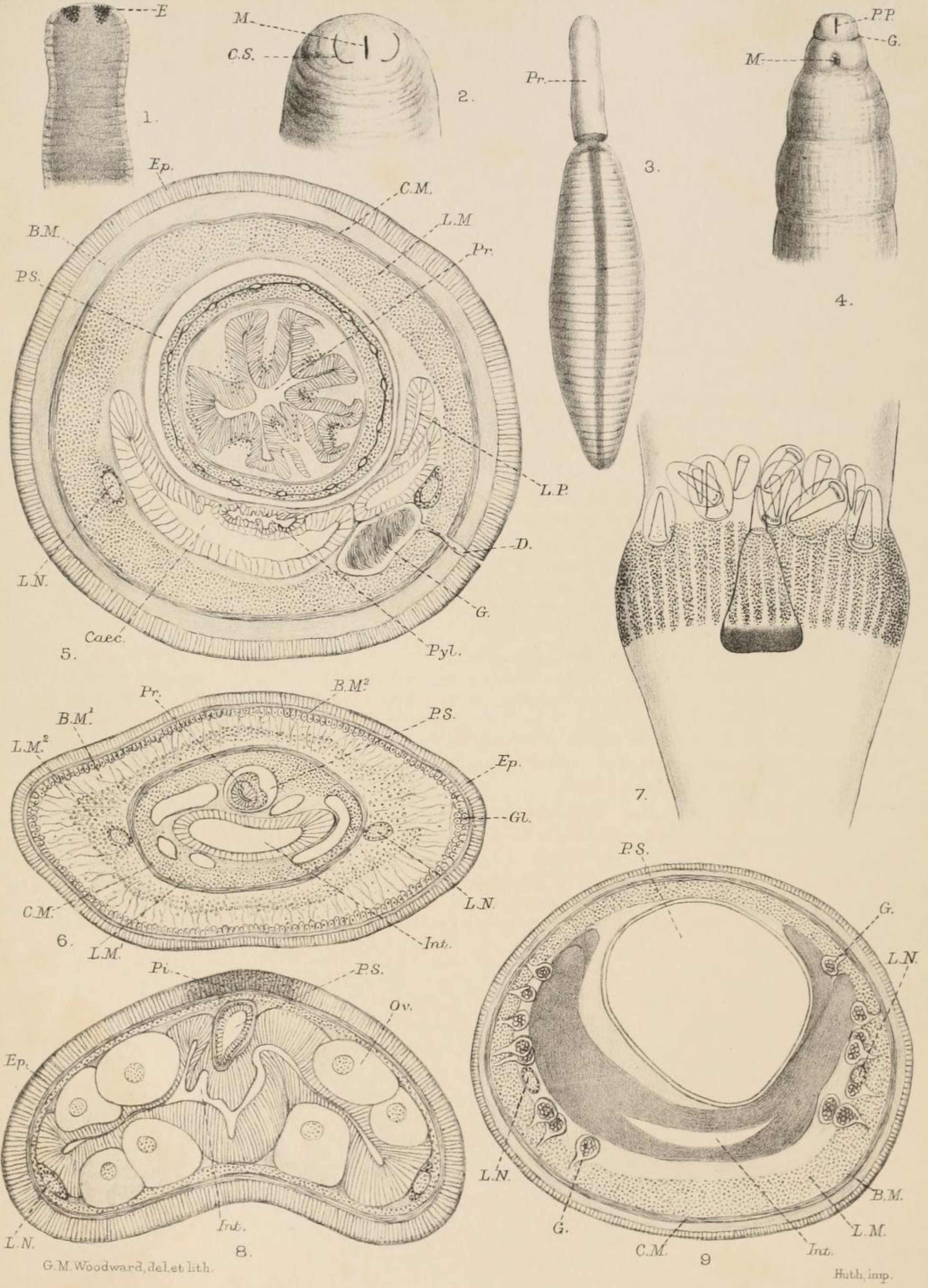
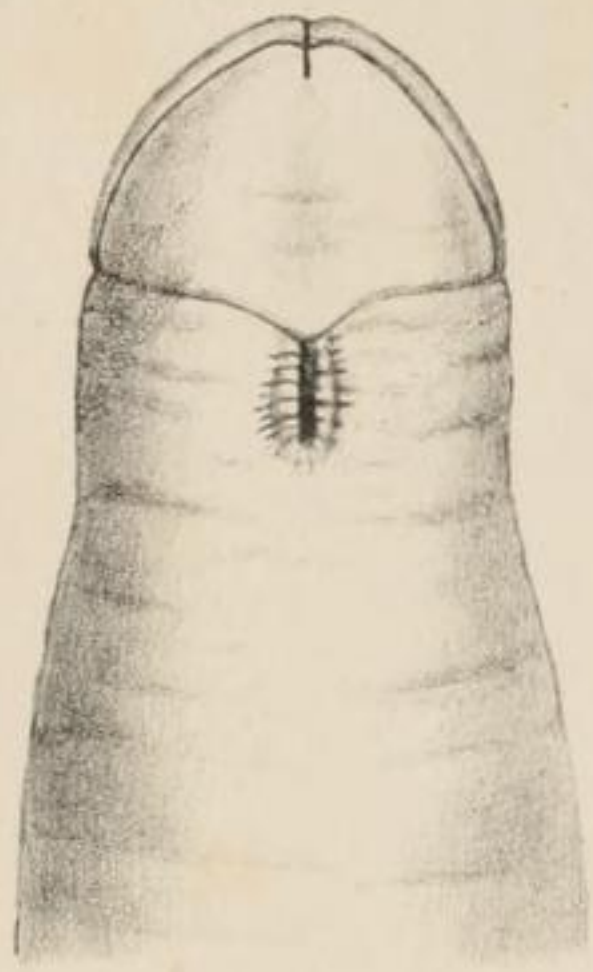


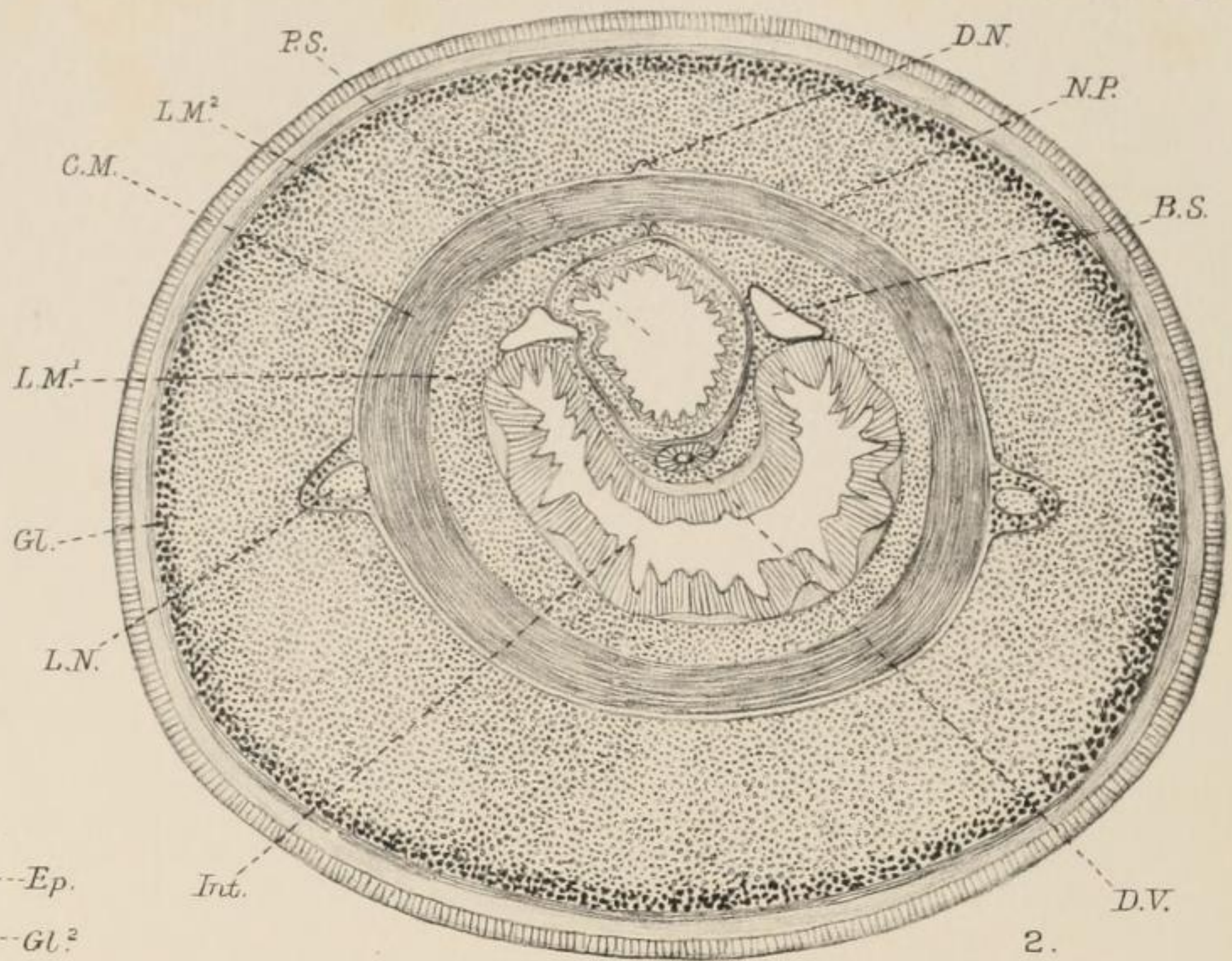
PLATE II.

Lineus scotti, sp. n.

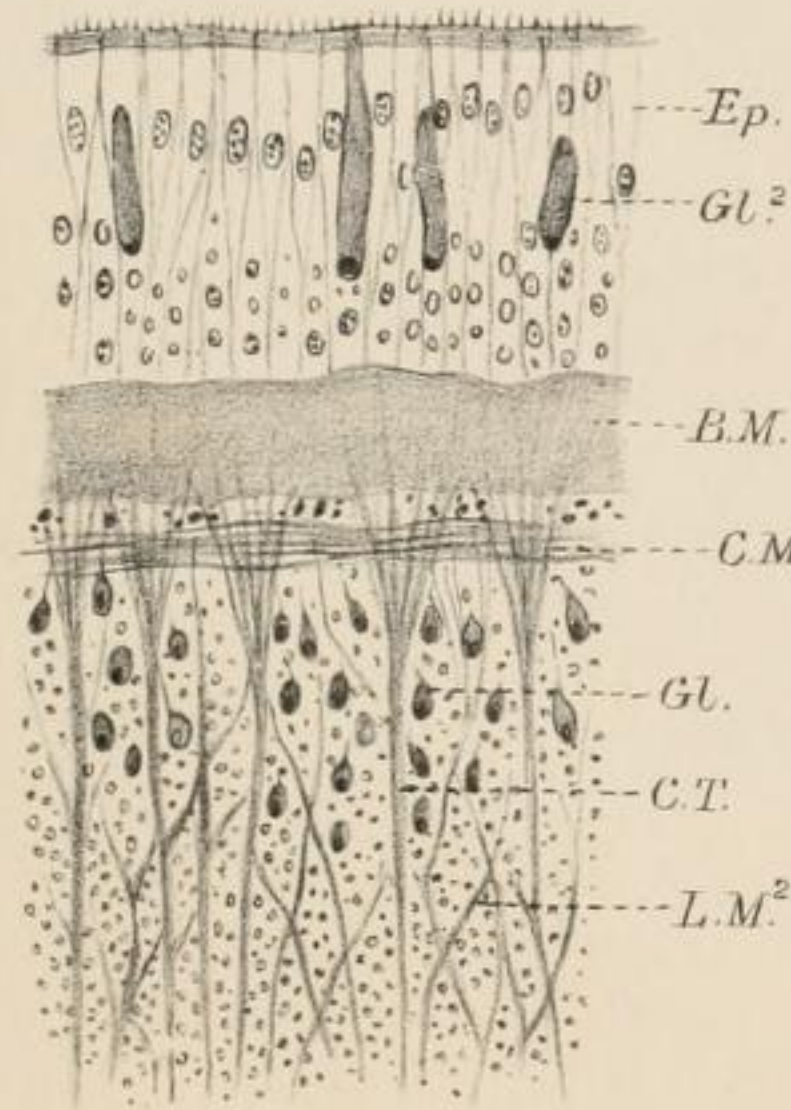
- FIG. 1.—Ventral view of the anterior end of one of the smaller specimens, magnified, and showing the mouth, cephalic slits, proboscis-pore, and the groove forming a “V” immediately in front of the mouth.
- FIG. 2.—Transverse section towards the middle of the body. B.S., blood-sinus; C.M., circular muscle-layer; D.N., dorsal nerve; D.V., dorsal blood-vessel; Gl., glandular layer of the integument; Int., intestine; L.M¹., inner longitudinal muscle-layer; L.M²., outer longitudinal muscle-layer; L.N., lateral nerve-stem; N.P., nerve-plexus; P.S., cavity of proboscis-sheath.
- FIG. 3.—Portion of the outer part of the body-wall in transverse section, highly magnified. B.M., (secondary) basement-membrane; C.M²., layer of circular muscle-fibres; C.T., connective tissue strands; Ep., external epithelium; Gl., glandular layer; Gl²., gland-cells of the epithelium; L.M²., outer longitudinal muscles.
- FIG. 4.—Transverse section immediately behind the brain. B.S., blood-sinus; C.C., cerebral canals; C.M., circular muscle-layer; C.O., cerebral organ; D.N., dorsal nerve; D.V., dorsal blood-vessel; Gl., glandular layer; L.M¹., inner longitudinal muscle-layer; L.M²., outer longitudinal muscle-layer; L.N., lateral nerve-stem passing outwards from the brain; P.S., cavity of proboscis-sheath; V.B.S., ventral portion of blood-sinus.
- FIG. 5.—Transverse section through the middle region of the body of a female specimen. B.S., blood-sinus; C.M., circular muscle-layer; D.V., dorsal blood-vessel; G., gonadial sac, filled with ova; Int., intestine; L.M¹., inner longitudinal muscle-layer; L.M²., outer longitudinal muscle-layer; P.S., cavity of proboscis-sheath.
- FIG. 6.—Transverse section through the proboscis, highly magnified. C., C., points where the circular muscle-fibres cross each other dorsally and ventrally; N., longitudinal nerves.



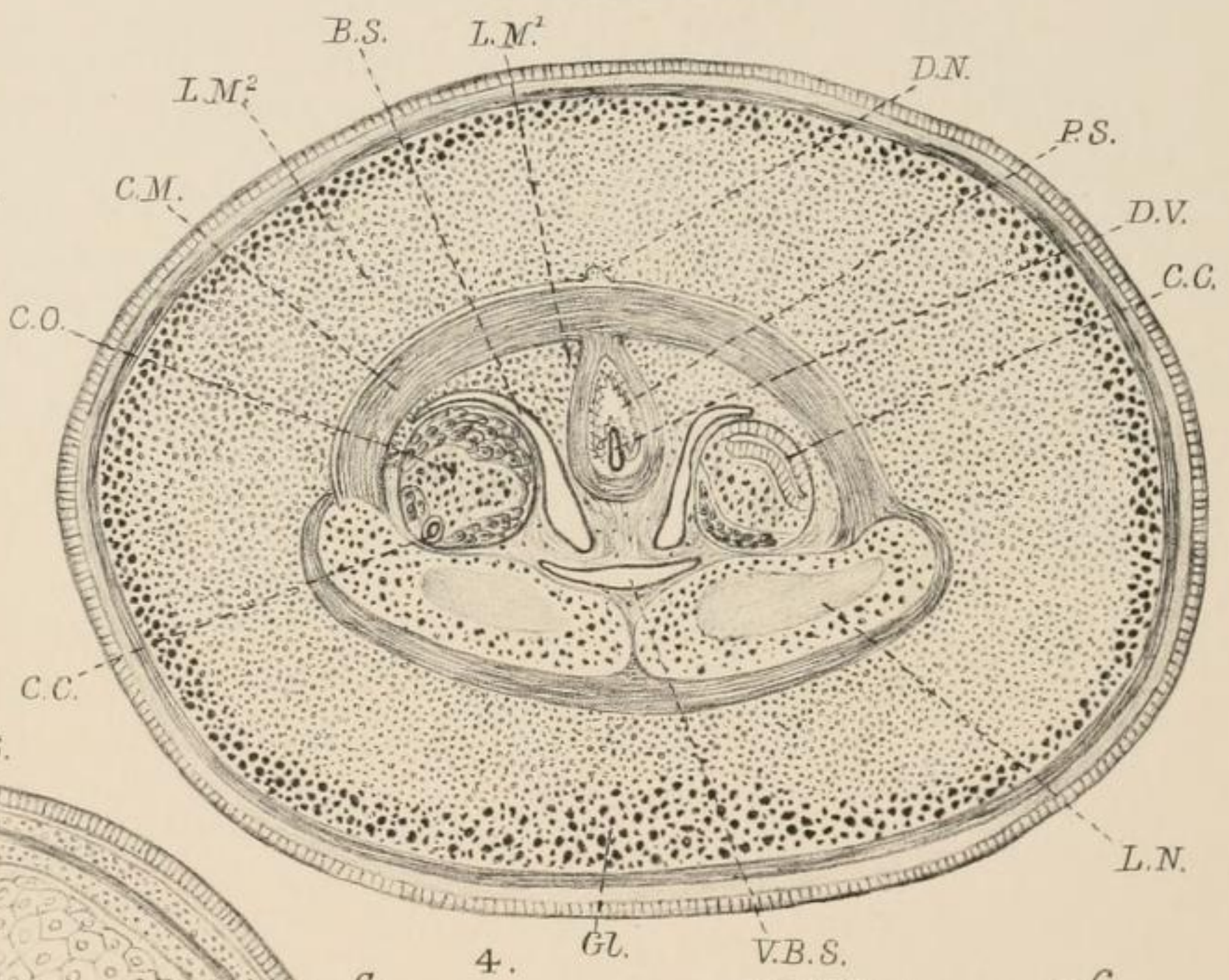
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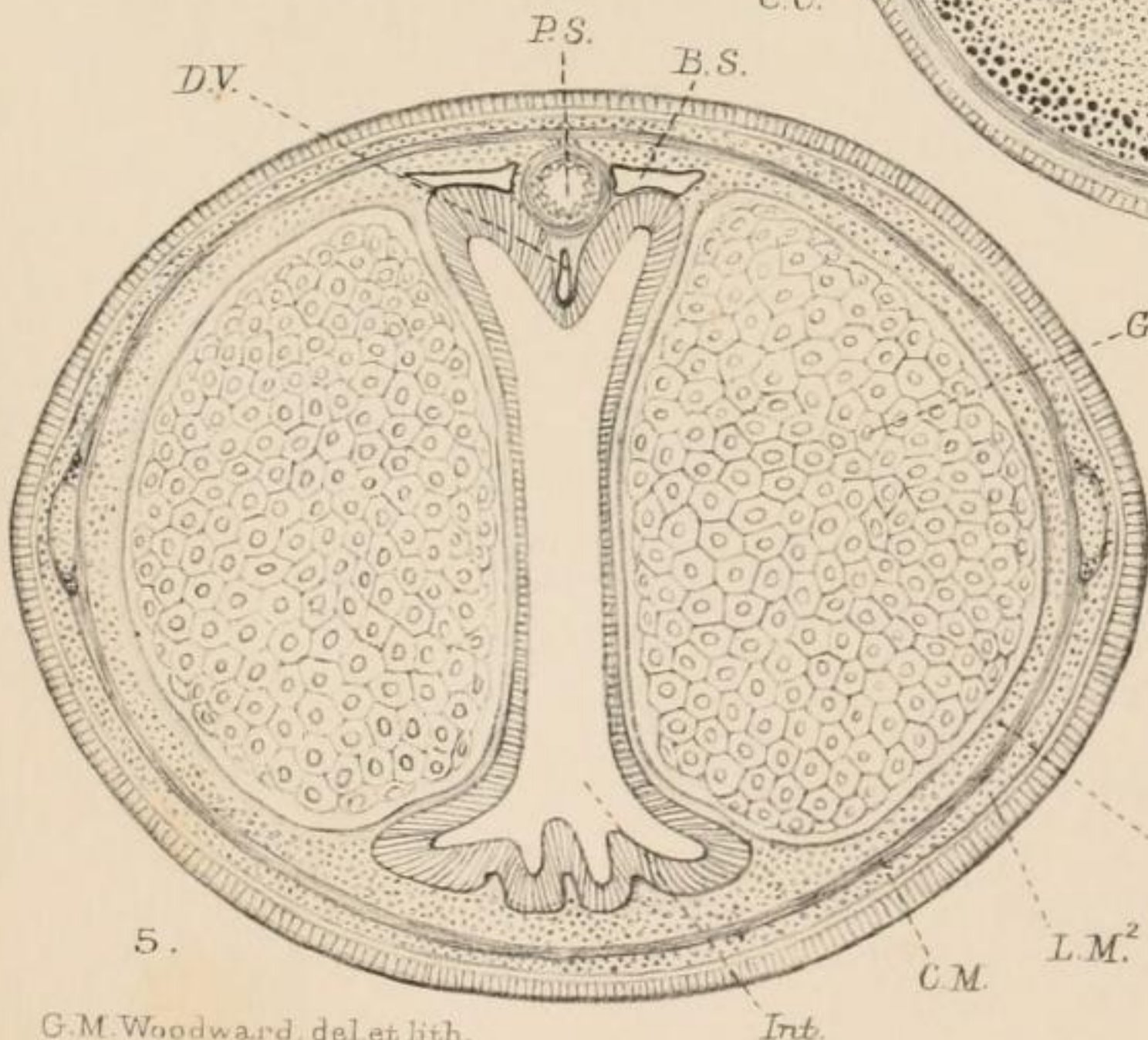
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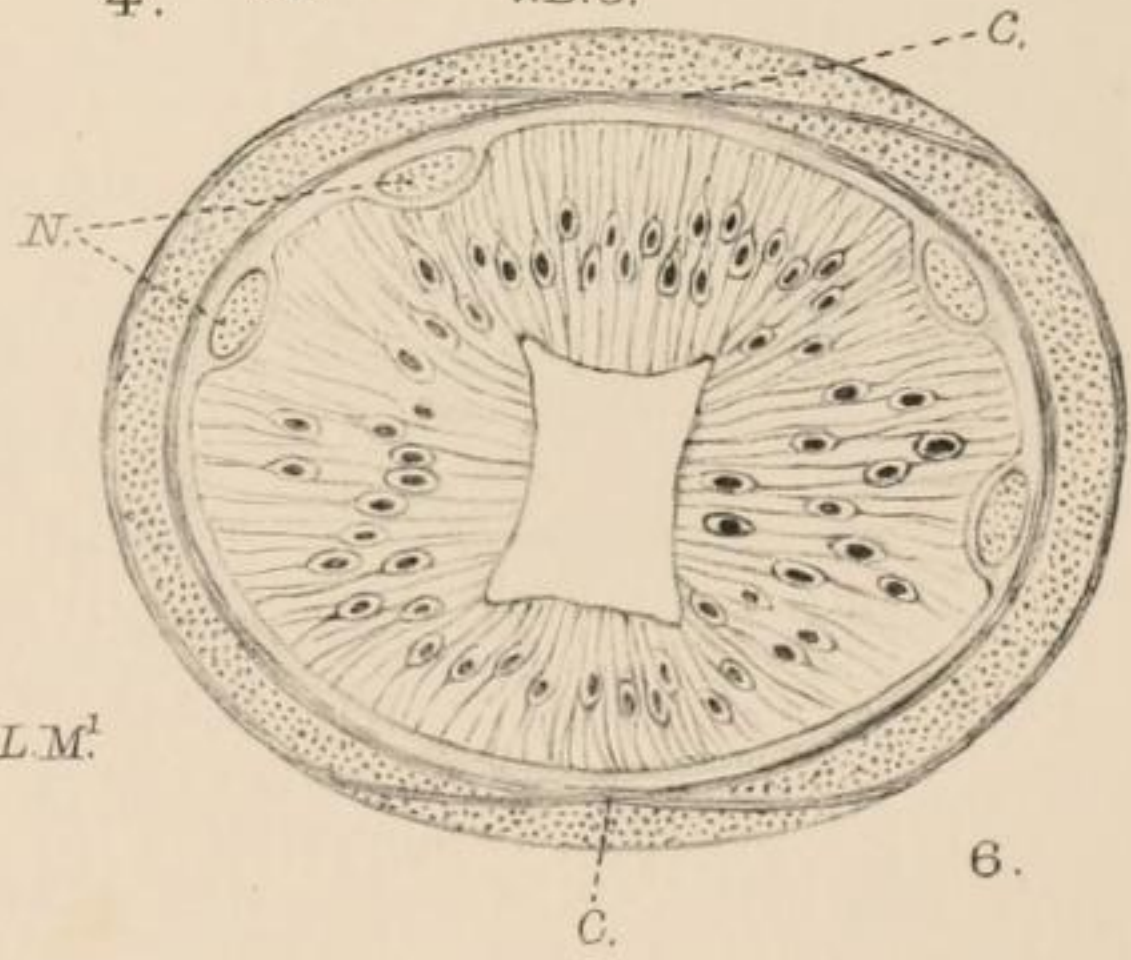
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BRITISH MUSEUM (NATURAL HISTORY).

BRITISH ANTARCTIC (" TERRA NOVA ") EXPEDITION, 1910.

NATURAL HISTORY REPORTS.

ZOOLOGY. VOL. II.

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AND WORMS.

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] I ;

NEMERTINEA.

BY H. A. BAYLIS, B.A.

WITH FORI; KICKS IN TIK TKXT AND 1 LATES I-It.

I.- General.

Remarks <>u the collection, \vitli Summary .

Mel In uls of stul"

Talile uf Collecting Sratiiuis ami Species tukrn

II. Systematic and Morphological.

Descriptions <>' . and remarks mi, the various s]

Fam. Ainphiporidiu . . .

Prostomatidse

Baseodiscidse

Lineido>

III. Literature

1 II

I L5

I 1C,

118

I L'n

I -2-2

L34

I.-GENERAL.

THE" Nemertinea collected by the "Terra Xova " came, for the most part, from the Antarctic and Subantarctic regions; chiefly from dredging-stations in the Ross Sea and McMurdo Sound.

Three species, each represented by a single specimen, were captured off New Zealand.

The total number of species in the collection is small, and of this number very few are certainly new to science. A survey of the whole collection gives the following results :

Total number of species, 10.

both from the Antarctic regions.

The three doubtful forms are :

(i) From the Antarctic regions :

A very small specimen, apparently belonging to the genus *Cerebratulus*, and probably very young.

(ii) From New Zealand :

Two species probably belonging to the genus *Limen**, each represented by one specimen only. They are referred to in the sequel as *Limen*, spp. " A " and " B."

The material on the whole is very well preserved, and no difficulty, on the ground of preservation, has been experienced in making out microscopic details by means of sections or otherwise. On the other hand, the number of specimens in some cases is so small that it was thought undesirable to dissect them to any great extent, and the accounts given of their structure must be regarded as subject to modification at some future time, when more abundant material may be available.

It is a matter for regret that almost no record appears to have been kept of the colours and markings of the various species during life. The specimens, by the time that they were handed over to me for study, were all, with a very few exceptions which will be mentioned in their appropriate places, deprived of all traces of their natural colours by the spirit in which they had been stored.

Transverse sections taken by hand were employed as a means of assigning many

of the specimens to their position. This method was found extremely valuable for rapidly sorting individuals which were so contracted, or of such nondescript external appearance, as to be inseparable by mere inspection. The sections were lightly stained with Paracarmine or Picrocarmine, and rapidly differentiated, dehydrated, cleared (preferably in Xylol) and mounted in Balsam. In the cases where serial sections were made, the best results were obtained by staining on the slide with Hsemalum, or with Delafield's Haematoxylin followed by Kosin.

was found useful in clearing some preparations, such as the proboscis of

[Begin Page: Page 115]

M:IKKTINKA MAYLIS.

115

tlie Amphipod;'. in order to see details of structure without making permanent mounts.

The following Table gives a conspectus of the various collecting stations, and the species of Nemertinea collected at each station. The numbers in the left-hand column correspond to the numbers in thick type in the general "List of Collected Stations" of the Expedition (Vol. II., pp. III) :

Station

No.

1)1

131

220

1 " itiou.

294

314

316

331

338

339

340

355

356

From Summit, Great King, Three

Kings Islands, S. 1(1 \V., 25

miles (New Zealand)

Spirits Bay, near North (.ape. New

Zealand.

Off Cape Adare, mouth of Itobert-

son's Bay (Antarctic).

Loss Sea, Lat. 71° 2' S., Long.

170° 3' E.

5 miles N. of Inaccessible Island,

McMurdo Sound (Antarctic).

Off Glacier Tongue, about 8 miles

N. of Hut Point, McMurdo

Sound.

< > Cape Bird Peninsula, entrance

to McMurdo Sound.

McMurdo Sound, Lat. 77° 13' S.,

Long. 164° 18' E.

Entrance to McMurdo Sound, Lat.

77° 5' S., Long. 164° 17' E.

Nature

of

Bottom.

11 fathoms (in

fathoms and

mitres).

Bock.

Shelly.

Shingle.

Species.

'on fms. (*Haseodiscus giurdii*.

(548 in.) / *I. innix*, sp. 'I;.'

11-2(1 fms.

(I'd :!7 m.)

45-50 tins.

(S2-112 m.)

158 fins.

(JS'J in.)

Mud. 222-241 fms.

(406-441 m.)

Undecomposed 190-250 t'ns.

animal re- (348-457 m.)

mains and

mud.

Mud.

It oss Sea, Lat. id 5li' S., Loni;

Kit 12'E.

.McMurdo Sound. Lat. 77 Hi' S.,

Long. Kir, 8' I-!.

I MI' Granite Harbour, entrance i,,

.McMurdo Sound.

250 fms.

(457 m.)

207 fms.

(379 m.)

140 fms.

(256 m.)

160 fms.

(2113 m.)

300 fins,

m.)

Mud.

. "H fms.

('J2 m.)

Amphiporus /".~<7n//.

.1. mult/hastatus.

Prostoma unilineatum.

I.i/i'im rnrriijntiix.

L. KI'IIIH.

I A mphiporus mostdeyi,

I. iii/ IIS I'I'I I-III/II/IX.

(L. xrutti.

(Baseodiscus uitt<ti i rt!nix.

(IAneua srii/ti.

I Aiii/i/iip/iriin iiiiltiixtiitiix.

Lnii in I'll

L. gruff!.

Amphiporus multihastatus.

Llinis i-i-nt'/itllfi.

(LineUS rrruiinimt.

\L. grtifi.

I Amphiporus moseleyi.

I Llnm i-iii' iijjn/i*.

I]. xrnlli.

I .' ('i rt lirnlii/iix. sp., juv.

\I.I IK'HH I'l'n'tlfl III*.

1 1. scoiti.

\Baseodiscus antarcticus.

i Linens m-r-tti.

\ Amphiporus multihastatus.

I I. ill, 11.1 I-lfl-H'JlItIK.

T 'J

[Begin Page: Page 116]

Hi; "TERRA NOVA" EXPEDITION.

II. SYSTEMATIC AND MORPHOLOGICAL.

ORDER METANEMERTINI.

FAM. AMPHIPORID.E.

AmpMporus, Ehrenberg, 1831.

I. *Amphiporus moseleyi*, Hubrecht.

Anijilij>orns Mim'leyi, Hubrecht, 1887, pp. 20-22 ; Pl. I, tigs. 20, 21 ; Pl. IX, tigs. 1, 7-9 ;

PL X, tig. 3 : Pl. XV, figs. 11, 12, 20.

Stations 220, 294, 339 : 45-158 fathoms.

The collection contains three small specimens and various fragments, including] (ieces of the proboscis, which I assign to this species, not, however, without some hesitation. The material being so scanty, and the specimens not attaining to the large si/.e of the types in the "Challenger" collection, though some of them are sexually mature, it may be questioned whether we are not here dealing with a new form. But on comparing the details of the proboscis-armature, and hand-sections taken through the whole animal, with the "Challenger" preparations and figures of this species, the resemblances are so great, and the differences so slight, that I do not feel justified in making a specific distinction.

With so small a number of specimens at my disposal, I was unable to cut

a series of sections, and have therefore no important contribution to make to the anatomy of the species. It may be remarked, however, that in the various transverse sections taken by hand, chiefly in the middle or posterior region of the lio. the lateral nerve-stems do not appear to be situated quite so far dorsally as in the type material. Hubrecht, indeed, lays particular emphasis on the point that the nerve-stems lie ulioce the lateral gut-caeca in *J. moseleyi*, and notes this as one of the characteristic features of the species. In the examples now under consideration the nerves do, apparently, lie at some, distance from the lateral margin of the body, and nearer to the dorsal than the ventral side, but they are not entirely dorsal to the gut-cajca, parts of which extend outwards both above and In-low them, and may be said to envelope them, as it were, on three sides. This slight discrepancy may, of course, lie due merely to different states of contraction, or to a difference in the level at which the sections were cut.

The nerve-layer of the. proboscis, as \ find is the ca.se in the " Challenger material, contains fourteen longitudinal nerves.

The genital organs are also arranged as stated in Hubrecht s account.

[Begin Page: Page 117]

XKM KRTIXEA BAYLIS. 1 1 ~

The unlv other point speciallv observed was the great development, in sonic specimens, of muscle-bundles running through the gelatinous parenchyme in a dorso-ventral direction. Tliese innsclcs pass through the longitudinal iniisele-layer. ami are connected \ v ith the circular muscle-layer dorsally and ventrally.

1'. . I ui/ill i/mi-il* Hllltili<lxt<lllix. .loulilll. (Pl. I. figs. 1. _', f). 7. !).)

.liy.A,></-* miiH'ilKitlotii* |Punnett (!,t //.), .Lmliliii, 111 lo,],],. 11-12; Tcxt-lius. 1">, Hi:

Pl. T, ti&. 7, 8.

Stations L'L'O. :, Hi. ::;', I . ::;"K; : -JJ -250 fathoms.

This species appears to lie tolerably abundant in and near McMurdo Sound, li was first recorded from ('ape Adare. in the "Southern < 'ross " collection, and some of the " Terra Xova " material comes from the same locality. The collection contains thirteen specimens ami some fragments belonging to this species. As it has lieen possible to cut some serial sections, and to examine the proboscis carefully, a tew points in the structure of the species, which have not previously Keen described, may now lie noticed, and a fe\ v measurements given.

EXTERNAL FKATT i; KS.

The largest specimens measure aliout .") cm. in length. Their thickness, according to the state of contraction, is very variable.

The alimeutary canal and proboscis-sheath have a common opening on the head, in the form of a median vertical slit (Pl. I. iig. ~2. M.). The external openings of the cei-eliral organs are in the form of crescentic slits, mainly transver.se in direction (Pl. I. iig. ' _'. C.S.) Numerous eyes were found to lie pre.seut : they are situated rather deep in the sulstance of the head, ami are arranged in two lateral patches (Pl. I. tig. 1, E.).

J NTKKXAL ANATOMY.

.Viuii'itnri/ < 'ii/ni/. The oesophagus is at first (in the region of the brain) very narrow. Soon, however, it expands into a voluminous stomach, with much folded walls. This is succeeded again by a narrower pyloric canal (PL I. fig. 5, Pyl.) which opens into the mid-gut at about 4 mm. (in a spirit specimen, as calculated from serial sections) from the tip of the head. There is a large caecum (Pl. I. fig. 6) extending forwards from this point, ventrally to the pyloric canal, as far as the posterior end of the folded stomach, with which it appears to lie in close contact. This caecum sends out numerous lateral pockets (Pl. I. fig. 6, L.P.), which curve upwards within the muscles of the body-wall.

Fig. 6. - The most striking feature of the proboscis in this species, as Mr. Loew notices, is its very great thickness in proportion to the animal's body. Its anterior portion is exceedingly muscular, and its diameter is about equal to half that

[Begin Page: Page 118]

US "TERRA NOVA" EXPEDITION.

of the body (Pl. I. fig. 6, Pr.). The nerve-layer of this portion of the organ contains sixteen longitudinal nerves.

The armature of the proboscis (Pl. I, fig. 7) is quite distinctive. The stylets are of a blunter and stouter shape than is usual in the genus, and are particularly broad at the base. The functional stylet measures 0.25 mm.-0.40 mm. in length, and in width, at the point of attachment, 12 mm.-0.22 mm. The basis of the functional stylet is also very broad and stout, and is of a somewhat triangular outline. It measures 0.70 mm.-1.3 mm. in length, and 0.4 mm.-0.8 mm. in width at its thickest part, which is posterior.

The reserve stylets are contained in twenty-eight or thirty pockets, arranged in a circle round the bulbous expansion of the proboscis (Pl. I, fig. 7). Each pocket contains one, or at most two, stylets.

Body-wall. The external epithelium stands on a comparatively thick basement-membrane (Pl. I, figs. 5 and 9, B.M.). The circular muscle-layer is not very thick, but the longitudinal layer (Pl. I, figs. 5 and 9, L.M.) is well-developed, and about equal in thickness to the external epithelium and basement-membrane together.

Cephalic Organs. Each of the crescentic apertures leads into a cavity which is wide at first, but soon becomes a narrower tube, circular in section, running backwards and inwards to come into connection with the anterior part of the brain. The inner end of each organ is surrounded by the usual ganglionic and glandular structures.

Genital Organs. In both sexes the gonads are arranged in a manner very similar to that of *J. moseleyi*; i.e., they are distributed round the inside of the body-wall, so that several may be seen in the same transverse section (Pl. I, fig. 9, G.), and without any definite alternation with the gut-caeca. Their ducts open, for the most part, at the sides of the body, but towards the hinder end, where the genital sacs are more numerous, some of the openings are dorsal and ventral.

FAM. PROSTOMATIDAE.

J. moseleyi, Ant. Duges, 1828. [= *Tetrixheimia*, Ehreberg, 1831.]

3. *Proxtonia inifitii* (Joubin). (Pl. I, figs. 3, 8. Text-figs. 1-2.)

Tritantia unilineatum [Punnett (in litt.)], Joubin, 1910, p. 12; Pl. I, fig. 1).

Stations 220, 339 : 45-140 fathoms.

Of this pretty little species there are nine examples in the present collection.* The type specimens in the " Southern Cross " collection are in poor condition, but there can be little doubt of the determination of these individuals. One of them (Pl. I, fig. ;i)

individu

* At the time of studying the material, only two specimens were available. Seven more very small individuals were subsequently sorted out from am<m<; dredged material from Station 220.

[Begin Page: Page 119]

NEMERTINEA I'.AYLIS.

is somewhat larger th.-ni I lit- type specimens, the body measuring H mm. in length, and :! nun. from side tu side at the widest part, which is about tin- middle. The animal tapers towards the head and tail. The dorsal Mirlace is convex, the ventral snrt'ae concave. The proboscis was extruded to a distance of ."> nun., but is now broken oil. and a microscopic preparation has Keen made i>t it to show the annatnre.

Several of the specimens are very minute, measuring milv about '2 mm. in Length.

The coloration (in spirit) is as follows: the dorsal side is of a yellowish flesh-colour, with a distinct reddish-brown pigmented median stripe ;

the ventral side is of a pale ochraceous yellow.

The four larval eyes have been made out

O

lives clearing in creosote. The two on either side

lie close together, one behind the other. (Text-

fig. 1.)

, ANATOMY.

FIG. 1. *Paratubificora unilineatum* : dorsal view

of the anterior end, magnified, showing

the eyes (K.)

The anatomy has not been fully worked out,

as serial sections have not been cut. A few transverse sections taken by hand reveal the

following characters :

External epithelium. The external epithelium (Pl. I, fig. 8, Ep.) consists of very tall cells,

interspersed with many unicellular glands and their secretions, which are seen escaping

to the exterior. It rests on a thin basement-membrane, which separates it from the

circular muscle-layer. Both this latter layer and the succeeding longitudinal layer are

thin and but feebly developed.

(h-n. The largest specimen is a female, and the entire space within the

longitudinal body-muscles, where not occupied by the gut and its lateral diverticula. or by the proboscis-sheath, is filled with eggs of relatively enormous size (Pl. I, fig. H, (>v.). measuring about 0.4 mm. in diameter. Their nuclei are also large (0.08 mm. ' 1 mm. in diameter) and contain many refringent globules.

Proboscis-sheath. The proboscis-sheath is proportionally large, and is supplied with strong circular muscles.

The proboscis is relatively very stout, but its armature is minute, in accordance with the small size of the whole animal. The form of the central stylet and its basis is represented in text-fig. 2. The basis measures 0.1 mm. in length. There are two pockets containing reserve stylets to the number of about four in each.

IMC. -i.ProxtonHi ii

tum: the functional
stylet of the penicillaris,

and its basis,

via<iiitic'il.

[Begin Page: Page 120]

I-jn "TERRA NOVA" EXPEDITION.

ORDER HETERONEMERTINI.

FAM. BASEODISCIM.

Baseodiscus, Diesing, 1850. [= Enpn/i/i, Ilubrecht, 1SS7.]

4. Baseodiscus antarcticus, sp. n. (IM. I. tigs. 4, 6.)

Stations 314 ami 355: McMurdo Sound, l'l'i'-.'SOO fathoms.

A fairly distinct constriction immediately behind the mouth, when the head is not retracted.

Cephalic grooves lateral and vertical. Mouth small and circular. Primary basement-membrane of cutis deep, but loose, and with many radial muscle-fibres. A well-developed layer of gland-cells in connection with the cutis. Bundles of fibres in outer longitudinal muscle-layer of body separated by much gelatinous tissue. Circular muscle-layer thin. Walls of gut not folded. Proboscis slender, and proboscis-sheath thin-walled.

Two specimens which I refer to this form occur in the collection.

The larger of the two measures 5 '5 cm. in length, ami lias a maximum thickness of !) mm. The smaller, which is apparently a young female, measures oulv 2 cm. in length and 5 mm. in thickness.

There is no trace of colour or markings upon either individual.

EXTERNAL FEATURES.

In the small specimen the characters of the head (Pl. I, fig. 4) can be fairly well made out ; it is marked off from the body by a moderately distinct constriction, immediately

behind the mouth. The proboscis-pore (P.P.) is a well-marked vertical slit just below the apex of the head. The shallow cephalic grooves ((jr.) are lateral and vertical, and apparently do not form a complete ring. The mouth (M.) is small and circular, with regularly wrinkled margin.

In the larger example the head is much retracted, and little of these features can be made out with certainty.

INTERNAL ANATOMY.

A small piece was taken from about the middle of the body of the small specimen, and cut into transverse sections (Pl. I. fig. G). These reveal the following features:

The external epithelium of the body (Ep.) consists of tall cells, resting on a secondary basement-membrane (B.M 2 .), succeeded by two thin layers of muscle-fibres, an outer circular and an inner longitudinal. Beneath the latter is a well-developed layer (Gl.) of large glandular cells. Next comes the thick primary basement-membrane (B.M 1 .), consisting of a rather loose connective tissue, through which many bundles of muscle-fibres pass outward radially.

The outer layer of longitudinal body-muscles (L.M 3 .) comes next in order. The

[Begin Page: Page 121]

XK.M ERTIXEA BAYLIS. I L> I

bundles of fibres belonging to this layer are somewhat scattered, and are embedded in a considerable amount of gelatinous and solid-looking connective tissue.

The circular muscle-layer (C.M.) is thin. Between it and the outer longitudinal muscles lie the large lateral nephrosomes (LN.).

The inner layer of longitudinal muscles (L.M. 1.) is comparatively thick and dense. Beneath it lie the proboscis-sheath (P.S.), the gut, and a certain amount of loose connective tissue. In this connective tissue, between the muscles and the gut, there are numerous large spaces, some of which are probably blood-sinuses, but others appear to be the gonadial sacs. The former are situated dorsal and ventrally, the latter at the sides. In the anterior part of the series of sections these gonadial spaces are empty. In more posteriorly ova are beginning to lie developed from their walls. The ova always appear on that side of the sac which is towards the exterior. The sex of the larger specimen was not determined, and I am unable to give any particulars as to the arrangement of the gonads in the male.

The gut (IM. 1, fig. (I, Int.) is simple and spacious, and its wall is not folded.

The proboscis is feebly developed, and its sheath is thin-walled, and not abundantly provided with muscles.

With such scanty material available, nothing further can be said at present of the anatomy of this species. Its chief interest lies in the fact that it is the only member of the genus as yet recorded from truly Antarctic waters, unless we accept *Antarctosyllis* as a "good" species. I shall further state my views with regard to this question under the heading of *Antarctosyllis* but I may be permitted to remark here that I can see no reason for referring that form to the genus *Eurythoe* (or *Antarctosyllis*). If this view be correct, the present species will be the only one, I believe, hitherto recorded from a latitude further south than 41°.

5. *Baseodiscus giardii* (Hubr.)

Knj.,,1!,, ,/;/i;Ui [M'Tnttish (in lift.)], Hubrurht, 1SS7, [']>. 11 l:i: PI. 1, figs. 7-9; PI. \ ' :
PI. VI, figs, t-11 ; PI. VII, figs. 4, 5, s ; PL X, fig. G ; PI. XI, fig. !:>."

Station '.)] : :',()0 fathoms.

A single specimen taken near Three Kings Islands, New Zealand, appears to belong, in all probability, to this species. It measures about (i cm. in length, and has a thickness of (i mm. The head-end tapers somewhat, and shows a faint surrounding groove, as described and figured by Huhrecht. The tail is conically pointed, and thicker than the head.

The specimen is a female.

No traces of colour can now be made out.

[Begin Page: Page 122]

|-JL> "TKiniA NOVA" EXPEDITION.

FAM. LINEID.E.

SUB-FAM. LINEIN^E.

Liiii'iix, Sowerby, 1806.

(i. fsiiii'ii* i-nri'iKjiitiif. M'lut. (Text-figs. -3-4.)

Linens crm<j< t tnX, M'Intosh, 1876, pp. 322-323. M'Intosh, 1871), p. 262; PL XV, figs. 17,

18. Stucier, 1879, p. 123. Biirger, 1904 (1), pp. 90-97. Joubin, 1910, pp. 2-8;

Text-figs. 1-10 ; PL I, figs. 1-5.

CcrelriifiiJnx rvrrugatus, Hubrecht, 1887, pp. 41-43; PL I, fig. 17; PL XI, fig. 9 ; PL XII,

figs. 3, 4 ; PI.' XIII, figs. 1-6 ; PL XIV, figs. 2-4. Joubin, 1908, p. 6.

1 Cerelirat/ilns rhurcoti, Joubin, 1905 (1), pp. 315-318, and text-figure. Joubin, 1905 (2),

p. 432. Joubin, 1908, pp. 2-6 ; Fig. 1.

LlieuK Itaisi-tii, Joubiii, 1910, pp. 8-9 ; Fig. 11.

Eupolia punnetti, Joubin, 1910, pp. 9-10 ; Figs. 13, 14.

Stations -2-20, 294, 316, 331, 338, 339, 340, 356: 45-250 fathoms; Station

3 '2 4, McMurdo Sound, on shore.

This fine species forms the hulk of the present collection, having been captured at nearly all the dredging stations in the Ross Sea and McMurdo Sound, where it is evidently very abundant.

The best account of this form is still that of Hubrecht (1887) in the report on the " Challenger " collection. His description and figures of the histological details of the body -wall in particular are most accurate and complete.

The original description of the species by M'Intosh (1876) is very brief, and may be quoted here in full :

" Body (in spirit) flattened, rather abruptly pointed anteriorly, and more gradually

posteriorly. The cesophageal region is marked externally by a series of prominent and somewhat regular rugae, which sweep from the mouth dorsally and ventrally ; so that the dorsal view recalls that observed in *Ar/cn* uter.

" Colour dark olive throughout, with the exception of a white band, which crosses the anterior border of the snout, and passes backward to the posterior third of the lateral fissure, where it bends dorsally and terminates.

" The special characters are the very large mouth, with the prominent rugae, which show that the animal probably possesses unusual powers of cesophageal protrusion a supposition borne out by the great development of the external circular muscular fibres and the succeeding longitudinal coat of the organ. The internal glandular lining is also very firm. The outer layers of the proboscis correspond with the type in the *Liueidae* ; but the internal longitudinal layer is largely developed."

In sixe the specimens in the present collection vary very greatly; the smallest of the young individuals measure about 6 cm. in length, and are generally coiled ventrally in a spiral when in spirit. The largest specimen is 65 cm. in length ; this example was found "washed up on Hut beach, Feb. 28th, 1911, "and is in a

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very expanded cuuillitioii. Another measures .V_> cm., and there aiv several of nearly tin's size.

I he colours <>t flic large examples arc no longer distinguisliable sonic arc

perfectly white, while others have apparently been discoloured by the spirit in which they were kept.* The vomit, however, still show the characteristic markings mentioned in McIntosh's description. The ground colour is now (in spirit) a dirty reddish brown above, somewhat paler below, and with slight indications of a paler longitudinal stripe on either side in some cases. The cephalic slits are edged with white, and a white streak passes dorsally from near the hinder end of each slit, forming a nearly complete band across the head.

In some of the large examples the head is exceedingly elongate. The nonth measuring 2-3 mm. (in the "Hut beach" specimen 2.5 mm.) in length, and the cephalic slits about 1 mm.

One specimen, measuring about 1.5 cm. in length, exhibits a very marked flattening of the posterior end, which led me to question whether this was not of a different species from the rest. It is, indeed, remarkably similar to the form described by Joubin (1905) as *Cerebratulus charcoti*. By means of sections, however, I have satisfied myself that there is no ground for believing that it is not an example of *C. cuneatus*. It is a male, and in the flattened posterior portion the testes may be seen in section, disposed peripherally within the muscles of the body-wall. The various layers of the body-wall are much reduced in thickness in this region, and the muscle-layers in particular appear at this point to be very weak. Hence the probable explanation of the flattening (which is seen in varying degrees in other specimens also) is that at the time of sexual maturity the body-wall becomes reduced in thickness, and less strongly muscular, in order to provide more room for the sexual products which are ripening within. The natural result of this process would be that the weakened portion would participate less fully in the muscular contraction which takes place under the action of a fixing reagent, and, if already flattened, would remain so.

I have been led, during my investigation of this species, to entertain doubts as to the validity of certain other species from Antarctic waters, and it is appropriate here to make some reference to them. While working on the " Terra Nova " collection I have had at my disposal the types of the " Challenger." " Discovery," and " Southern

* The following note on their colours during life has been submitted to me by Mr. D. G. Lillie :

The long Xtneiu-like specimens obtained in the Antarctic were of a purplish light red or terra colt, -i colour on the dorsal side, and a yellowish-creamy white on the under surface. The colouring was Y<TV much alike in all the larger specimens obtained." He adrls, with regard to this species, that " they had great power of elongating anil contracting their bodies."

f The "Hut beach" specimen is flattened throughout its entire length, but it is prol>, -ible that this individual was in a moribund condition when collected, and f do not. attach any importance to its exceptional appearance.

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Cross" collections. Among them there are good series of sections of Linen* corrugatus, Linetis hanseni, and Eupolia punnetti. I have worked through all the series, paying particular attention to those (twelve in all) which were taken through the heads of the worms, and which show the arrangement of the brain, cephalic organs, and blood-spaces in that region. On carefully comparing all these series together, and also with the "Terra Nova" specimens of L. l'ori'ngatti*, I can find no reason, either in the grosser

anatomy, or even in the finer details of histology, for regarding any of them as distinct species, and I therefore consider them all synonymous with that originally described by McIntosh (1873).

One of the most characteristic features of *L. m'Intosh*, as has been noticed by M. Joubin (1910), is the arrangement of the large blood-sinuses in the head. I have paid special attention to this system in all the species mentioned, and find it in every instance identical. Such slight apparent differences as there are, are evidently the result of different states of contraction, and are in no way due to any variation in structure. At the point where the blood-sinus traverses the nerve-collar it becomes so compressed in some specimens as to be almost obliterated, but it can nevertheless be traced, and shown to go through essentially the same changes at different levels, in all the specimens examined, and in all the "species" above named.

As my conception of this blood-sinus and its transformations differs somewhat in details from that of M. Joubin (1910), and as it is an important feature of the species, I have prepared a series of diagrams illustrating its appearance as it is traced back through any series of transverse sections, commencing with the snout of the animal. These diagrams were all outlined with the camera lucida, though they were not all taken from the same series of sections, as the vessels in a given region were better displayed sometimes in one specimen, sometimes in another, according to its state of contraction. In all, however, they could be traced with more or less ease, and reduced to the same plan.

Starting, then, with the tip of the animal's head, we find a single blood-sinus occupying a median position dorsal to the rhynchodaeum (Fig. 3, A.). This sinus soon widens out (Fig. 3, B.), and becomes divided into two lateral spaces by the development of a partition from the dorsal side of the rhynchodaeum to the opposite wall of the sinus (Fig. 3, C.). The blood-spaces, a little behind this point, come to embrace

the rhynchodajum between them, each being of a crescentic shape in transverse section (Fig. 3, D.). This condition remains constant until the region of the brain begins to be reached. The connective and muscular tissues in the centre now begin to increase at the expense of the blood-spaces, which become very attenuated (Fig. 3, E.-H.). This development of muscular tissue is the first indication of the proboscis-sheath proper, whose muscles are at this point continuous with those of the proboscis itself.

A space, or spaces, now begin to appear in the central tissue. These represent the beginning of the lumen of the proboscis-sheath, which soon completely surrounds

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Fig. 3. Diagrams of a series of transverse sections, illustrating the muscular system, which has been represented in solid black. The brain and nervous structures are hatched.

P., proboscis; P.S., cavity of proboscis-sheath; R., rhynchodajum, seen opening to the exterior in the first diagram (A).

A Shows the median blood-sinus in the snout, lying dorsally to the proboscis-pore (P.). Blood-sinus represented in solid black.

B The proboscis-pore has passed into the rhynchodajum (R.), and the blood-sinus is of wider calibre.

C The blood-sinus becomes divided into two by a partition of connective tissue developing on the dorsal side.

D There is now a complete wall of connective and muscular tissue dividing the two blood-spaces, and enclosing the rhynchodajum.

E Nerves from the anterior part of the brain are appearing laterally, and the central tissue, encroaching more and

more upon the blood-space-, so as to reduce them in si/c.

F The central muscular tissue begins to show spare.-, the beginning <>I tin- cavity of the proboscis-sheath (P.S.).

Blood-spaces still further reduced.

G The cavity of the proboscis-sheath is now seen completely surrounding the proboscis (Pr.), and -epa rated by a thin

wall from the blood-space on either side. The blood-spaces are pre^seil lii<tween the brain and the proboscis-

sheath. so as to lie MTV narrow at this point.

H The blood-spaces have coalesced ventrally, so as to form ;i T-shaped vessel encloMng the proboscis-sheath.

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the proboscis. It has only a thin wall ventrally and Literally, separating it from the blood-sinus, which is now a single I T -shaped cavity, the two lateral sinuses having coalesced below. (Fig- 3, H.)

The blood-sinns may be regarded as a single cavity throughout, broken up by the encroachment of bridges of connective and muscular tissue, which appear quite, irregularly, and are not always symmetrical on the two sides. Immediately after passing behind the brain, a median ventral blood-space is formed for a short distance, as shown by M. Joubin (Fig. 4, A.). This, however, is soon divided again into two lateral spaces (Fig. 4, B.), which become more and more widely separated by the intervening mass of connective tissue (Fig. 4, C.). This median space is quite distinct

from the vessel of the proboscis-sheath, and instead of passing gradually into it, as described by .Al. Joubin, never has any connection with it whatever. This vessel, usually called the dorsal vessel, though clearly belonging to the proboscis-sheath, is a small cavity in the wall of the sheath itself, on the ventral side, appearing first at the level of the hinder part of the brain, and extending, probably, throughout the length of the sheath. Its dorsal wall anteriorly is a very thin and collapsible membrane. Posteriorly the vessel sinks more deeply into the tissues below the proboscis-sheath, so that its dorsal wall becomes much thicker. Not having cut a whole worm into sections (which would be a somewhat extensive undertaking), I am unable to state what actually becomes of this vessel at the hinder end ; but so far as my evidence shows it is not, at any rate at the anterior end, in direct communication

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with the other system of sinuses. To continue the history of the main system, as we pass backwards through the series of sections to the region where the mouth and oesophagus appear, the lateral sinuses, at first few and large. (Fig. 4, C.), are seen to spread round the outside of the oesophagus, so as to embrace it laterally and dorsally, except for the interruption of the proboscis-sheath. They subsequently become more and more subdivided by the bridges of connective tissue and muscles, and at the same time smaller and less conspicuous.

Finally, behind the mouth, their condition is that of a network of quite small vessels almost completely surrounding the gut (Fig. 4, D.). They lie between the inner longitudinal body-muscles and the circular muscle-layer which surrounds the gut, and have now acquired a much more definite lining epithelium of their own. They now present, in fact, exactly the appearance described and figured by Hubrecht (1887, Pl. XIII, fig. 6).

One other point may be mentioned in connection with the vascular system, in which I cannot entirely agree with M. Joubiu's description (1910). He states that both in *L. i-orruijatnx* and in *L. hanxt'iii* there are certain "orifices" by which the cavity of the rhyuchodamm is in communication with that of the blood-sinus in the head. This communication is said not to be direct, but certain "ampulhu" in the thickness of the wall of the rhynchodseum are said to communicate through a kind of spongy tissue with the blood-sinus, being at their inner ends in direct

[Begin Page: Page 127]

P.S.

D

C.M.

Fig. 1. I

ini'ix cin-i-iii/iiiiig. -Continuation

Mack). CM., circular muscle-

||)-(II)IIScis slieatll.

Int

it' (lie scries uf diagrams illustrating the vascular- system (solid

; Int., intestine: M., inrmtli ; Oes., oesophagus; P.S., cavity of

A Bridges (if connective tissue and muscles beⁱⁿ to cross the blood-space irregularly, breaking it up into a network of intercommunicating vessels. A ,mall blood-vessel, with very thin dorsal wall, is now appearing in the wall of the proboscis-client b, mi the vent nil side. (The proboscis is no longer seen, having been torn out in this specimen.)

B A median ventral blood-space has appeared temporarily, but is already being encroached upon by the connective tissue, and separated into two lateral spaces.

C The branch,-. <>| the blood-- pace are becoming widely M-parated, and spreading round to embrace the walls of the

oesophagus and mouth, which have nou appeared.

D The final condition of the blood-space with its network of vessels. These now lie below the inner layer of longitudinal muscles, and cuiiipltch surround the intestine. The blood-vessel of the proboscis-sheath is still seen, its dor-al wall being an exceedingly thin membrane (exaggerated in thickness in the drawin-jl.

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communication with the lumen of the rhynchodseum. The figures given, however, are not altogether convincing ; ;ui<l on re-examining the material (which is not conspicuously well preserved), I have formed the conclusion that the "ampullae" are to a certain extent artificial results of the contraction of the wall of the rhyncliuda-um. They are, in fact, a kind of "hernia" of the lining epithelium, which is here and there pushed outwards between the muscles, thus forming minute diverticula still in communication with the main cavity of the rhynchodseum. They do not occur in all the series of sections examined, and are not, therefore, an

essential feature of the species. Moreover, their outer communications with the Mood-sinus are, I believe, imaginary. In no case have I detected any actual opening, and though they sometimes come very near to the surface. I believe that this appearance is entirely due to artificial causes.

Having already stated my conviction that *Linen** /tanvi'iii and *Eujmlia* /niuii'tti are synonymous with *L. i-orruyatus*, I may perhaps be permitted further to add that I feel some doubt as to whether *Cerebratulus charcoti*, Jonbin, should not come under the same category. The author's description (1908) does not appear to me to show any very satisfactory grounds for its separation ; no description or figures of its internal anatomy are given, and the main points upon which the distinction of the species is based are (1) the marked flattening of the posterior end of the body : (2) certain very vague features of colour ; and (3) the great length and attenuation of the head. Now (1) the flattening of the body, as I have attempted to show above, occurs in specimens which I cannot regard as other than *L. corrugatus* ; (~2) colour, in spirit - preserved material, can hardly be said to have any importance at all, being often affected by the pigments of other specimens, &c., which may have been immersed in the same spirit ; while (3) the comparative length of the head, mouth, &c., in these worms is a matter obviously dependent upon the growth of the individual and the mode of fixation or preservation employed, and may be extremely variable in preserved specimens of the same species.

Taking all these facts into consideration, I think the evidence points to the ((inclusion that in all four cases [*Linens l'iri'injatnn*, *Jjni'iix hanseni*, *Cerebratulus i-//n>'i'i>f* and *Kni>li*, punnetti) we are dealing with one and the same species, and that this is the form originally described by McIntosh (1873) under the name of *Linnix corrugatus*.

DISTRIBUTION.

By the inclusion of the several species above-mentioned in the division of
I., i-orriti/tftix, the range of the latter is seen to extend to the western as well as the
eastern side of the subantarctic regions. The specimens determined by M. Joubin as
Cerebratulus and *C. ruficornis* came from Booth-Wandel Island. I have also
to add that some immature specimens brought from Cumberland Bay, South Georgia,
by the late Major (4. E. II. Barrett-Hamilton's Expedition, 11) 1893-1914, belong, in

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my opinion. that the same species. Combining, therefore, all these records, we have

the following:-

These localities lie in a fairly complete circle, between the approximate latitudes
of 50° S. and 77° S., and it appears that we are dealing with a single common species
which extends completely round the subantarctic region. It is, perhaps, somewhat
remarkable that the species, occurring as near as South Georgia, should not have been
recorded from the Strait of Magellan, which lies well within its range of latitude ; and
possibly sooner or later it will be found there. Its northern range, however, with the
exception of Kerguelen and Heard Island, appears to lie within the extreme limits of
the pack-ice.

xi-offi. sp. n. (Pl. II, figs 1-4.)

Skin smooth. Head blunt and rounded. Mouth rather short. A transverse groove encircling the head behind the cephalic slits. The latter are deep, and communicate with the brain only at their hinder ends. Primary basement-membrane of cutis lacking. Glandular cells in epithelium with a brownish secretion. Outer longitudinal muscle-layer very dense and thick. Proboscis with four longitudinal lines. Us circular muscle-fibres form dorsal and ventral crosses. Cerebral organs large, projecting into lateral head-sinuses.

Length up to 10.7 cm. (probably often greater).

Stations - 10. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35. 36. 37. 38, 339, 340, 355 : 4.) 100 fathoms.

The species seems to occur together with *L. i-nri'iii/nfa** in nearly every case.

A number of specimens of tins *L. i-nri'iii/nfa**, which is clearly distinct from *L. cwruyatus*, occur in the collection. I have named this species in honour of the lamented Commander of the Expedition. The two forms, when in spirit, are generally readily separated by mere external inspection, though by this means some specimens of *L. i-nri'iii/nfa** easily be taken for immature individuals of *L. cwruyatus* which had become decolorised.

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EXTERNAL FEATURES.

The chief points in the external appearance of *L. xeutti* which serve to distinguish it from *L. rarriti/itfitx* are as follows:

The skin is comparatively smooth, and not thrown into marked wrinkles and furrows.

The head is usually blunt and rounded in front. The snout is, however, evidently capable of some extension, as in a small number of individuals it has been fixed in a more tapering form.

The young specimens do not appear to coil up ventrally in a spiral when killed, as do those of *L. t'ni-jatiin*.

The mouth (PL II, fig. 1) is a longitudinal slit, but not nearly so elongate as in the other species. In the largest individual it measures 5 mm. in length. The lips are thrown into regular folds transversely to the longitudinal axis of the mouth.

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There is in many cases a more or less well-marked transverse groove behind the cephalic slits. This is especially noticeable on the ventral side (PI. II, fig. 1), where it runs back in the middle line to meet the anterior end of the mouth, thus forming a V-shaped furrow.

The cephalic slits are very deep and clean-cut, measuring about 4 mm. in length in the largest individuals.

The proboscis-pore (PL II, fig. 1) is, as usual, a vertical slit at the tip of the snout, crossing at right angles a slight groove which joins the anterior ends of the cephalic slits.

In length, complete specimens (of which there are few) measure from 2 ' 4 cm. to 10 ' 7 cm. The larger specimens are all fragmentary, and it is impossible to guess at the maximum length probably attained ; but this would seem to be certainly very much smaller than that reached by *L. eornigattix*. In thickness, the largest fragment measures about 8 mm. laterally and 6 mm. dorso-ventrally ; the other specimens vary greatly in thickness according to their state of contraction.

No traces of the original colours of the species can be made out.

Nearly all the specimens appear to be sexually immature.

INTERNAL ANATOMY.

The outer epithelium (PL II, fig. 3, Ep.) consists of very tall ciliated cells, with numerous smaller interstitial cells at their bases. Between the tall epithelial cells are scattered many large club-shaped cells (PL II, fig. 3, (il.-) full of a refractive yellowish-brown secretion.

Below the epithelium there is a thin but solid-looking basement-membrane (B.M.), scarcely as deep as the epithelium itself. Beneath this again there is a thin layer of circular muscle-fibres (C.M.). A well-developed and conspicuous, deeply-staining layer of large glandular cells (Gl.) succeeds this, resting immediately upon, and being partly

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embedded among, the fibres of the outer longitudinal muscle-layer (LM 2.). The deep primary basement membrane, so conspicuous in *L. ruriii/iix*, separating the glandular layer from the musculature, is entirely absent.

The outer layer of longitudinal muscles (Pl. II, figs. 3, 4, 5, L.M. 2.) is exceedingly thick and well-developed. Its fibres are separated into groups only by slight partitions of connective tissue, so that under a low power of the microscope they appear closely and evenly placed together, and the whole layer has a very solid aspect. Between this layer and the circular muscles there is present the usual nerve-plexus (Pl. II, fig. 2, N.I.), with the two large and well-developed lateral nerve-stems and a small dorsal nerve.

The circular muscle-layer (Pl. II, figs. 2, 4, 5, (A.M.)), like the outer longitudinal layer, is very stout and solid in appearance. It is succeeded by a comparatively thin inner longitudinal layer (L.M. 1.). The last two layers together make up a thickness nearly equal to that of the outer longitudinal coat.

Alinn'ifiri ('nun). The intestine is U-shaped in transverse section (Pl. II, fig. 2, Int.), and without marked lateral diverticula. It seems to be characteristic of this species that the "crypts," or pockets, in the lining epithelium at least, in the cesophageal portion of the gut form very regular and acute angles.

Proboscis-sheath and Proboscis. The proboscis-sheath is larger in diameter, relatively to the size of the whole animal, than that of *T. ron'ii/f/**. Its lining epithelium rests on (1) a thin basement-membrane, followed by (2) a thin longitudinal

coat of muscle-fibres; (3) a thin circular coat of muscles, connected dorsally with the circular musculature of the body-wall; and (4) another coat of longitudinal muscles, which is in reality part of the inner longitudinal coat of the body-wall.

The dorsal blood-vessel (PL II, figs. 2, 4, 5, D.V.), or vessel of the rhynchocoele, as it might more descriptively be called, lies, anteriorly, on the inside of the circular muscles of the proboscis-sheath; more posteriorly, it sinks through the circular muscle-layer, and eventually comes to lie below it, among the outer longitudinal muscles. It has very thick walls, as compared with the corresponding vessel in

The proboscis is thin, and its musculature is not strongly developed. In transverse section (PI. II, fig. (!) some of the circular muscle-fibres are seen to cross each other dorsally and ventrally (C., (A), and pass outwards to the periphery, as in the common *Cerebratulus marginatus*. Within the circular layer of muscles there is a nervous layer, containing four large longitudinal nerves (X.). There is no inner longitudinal layer of muscles separating this nervous layer from the lining epithelium. The latter is mainly composed of tall glandular cells.

Vascular System. The blood-sinuses in the head are arranged on a plan similar in essential points to that of *Amphiprion*, already described; but after the I'-shaped sinus has passed behind the dorsal commissure of the brain, its two arms extend dorsally and outwards (Pl. 11, Jig. 4. U.S.), so as to embrace the dorsal ganglia and

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al organs. They then become separated by muscular tissue from the ventral portion of the "U" (Pl. II, fig. 4, V.B.S.), just as in L. n-ru. : i<itiix, so that there are for a short distance three apparently distinct spaces. Further back, the system of intercommunicating vessels is not nearly so elaborately developed as in the former species; the blood-spaces round the gut are by no means so distinct or so numerous, the most conspicuous being a pair of longitudinal vessels situated to right and left of the proboscis-sheath, dorsal to the gut (PL II, figs. 2 and 5, B.S.). A few smaller and more irregular vessels can be seen laterally and ventrally.

Si'iiNi'-nri/tuix mill Nervous System. There is a minute " frontal organ " at the tip of the snout, and the head is very abundantly supplied with gland-cells, some of which are probably connected with it.

The cephalic slits are very deep and straight-sided. There is very little expansion at the bottom of the furrows, which communicate with the 1 train only at their hinder ends. On the posterior wall of each slit there is a prominent transverse ridge, containing a groove which leads into the canal of the cerebral organ.

The upper extremity of the dorsal ganglion of the brain on either side ends immediately in front of the cerebral organ. In the anterior and upper part of the dorsal ganglia, the largest or " giant " type (Burger) of ganglion-cells are extraordinarily well seen, and are of very large size in proportion to the whole brain.

The cerebral organs (PL II, fig. 4, C.O.) are well-developed, large, and abundantly supplied with glands. On their inner and dorsal sides they are closely surrounded by the lateral portions of the cephalic, blood-sinus.

The lateral nerves, with their investment of ganglionic cells, run out almost at right angles to the long axis of the animal for a considerable distance on leaving the brain (PL II, fig. 4, L.N.), and then turn back to run in the usual manner along the sides. They are very stout, and lie somewhat towards the ventral side of the animal (PL II, fig. 2, L.N.).

There is a complete plexus of nervous tissue (PL II, fig. 2, N.P.) immediately outside the circular muscles of the body-wall, and a small dorsal nerve in this layer, in the middle line, as in *L. forniyatit**.

Genital OiyaiiK. In a female specimen examined, the gonads appear to form a continuous series along either side of the worm (PL II, fig. 5, G.). They compress the gut between them, and are not separated from their neighbours by any lateral gut-caeca. The eggs contained in this individual measure about 0.2 mm. in diameter.

I am unable, to give any account of the arrangement of the genital organs in the male.

Note : It may be remarked that there is nothing in my description of this form contradictory to the siippnsitiim that it is identical with *Cerebratiliim valitlus*, Burger, from South Georgia. On the other hand, the description (1893) of the latter species is based upon one specimen only, and is so brief that it would ! scarcely possible to determine the species from it, and moreover no figures are given. Hence I ha\c not hesitated to regard the " Terra Nova " material in the light of a new species.

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8, 9. I. iiii'lix. s|iji. " A " and " B."

" A," Station |:!4. ' 15." Slat inn) I .

There remain i \v<> specimens, apparently of tins genus, from the New Zealand waters, belonging evidently to two distinct spprirs : but as io rlic determination of these I prefer to reserve judgment. I hesitate to found a new species upon a single specimen, as the description must necessarily lie incomplete, and mav only lead to confusion. One of these two individuals, which I will call L\tn-nx s p. " A." is interesting mainly <m account of the following features: The liody is slightly flattened, and the head is shaped like an arrow-head, the posterior ends of the cephalic slits projecting considerably at the sides, and the snout tapering to a point. The cephalic slits are ;!'.") mm. long. Tin 1 mouth is small, and measures only slightly over '2 mm. in length. The skin is deeply pigmented, of a rather dark olive-green colour. The pigment - granules are closely crowdod together in the thick primary basement-membrane, and in another layer immediately outside the circular muscle-layer of the body-wall. Between these two main layers scattered granules are also seeu in the radiating strands of connective tissue among the outer longitudinal muscles. The snout, and the edges of the cephalic slits and mouth, are ochreous, and may perhaps have been red during life. [Length of specimen (tailless). 5 cm.]

SUH-FAM. MICRURIN^E.

Cerebratulus, Renier, 1804.

10. (Cerebratulus, sp. (jnv.)

Station 389.

There is a single very small specimen in the collection, with a minute tail-like appendage at the posterior end. The total length of the animal is about 7 mm. The skin is transversely wrinkled, and the general colour yellowish, thickly dotted with minute reddish-brown spots of pigment.

The snout is thick and square, and the whole head large in proportion to the body. The cephalic slits measure a little over 1 mm. in length. The mouth is elongate, but not large, and lies behind the cephalic slits.

It is only provisionally that I assign this specimen to the genus (*'ert'lrntiilu**. and I regard it as probably a very young individual.

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PLATK II.

Lill.'IHK K'l'liili, Sp. 11.

Km. 1. Ventral view of the anterior end of <>ne <if tin- smaller specimens, magnified, and showing the month, cephalic slits, proboscis-pore, and the groove forming a " V >: irmuediately in front of the mouth.

Kir;. 2. Transverse section towards the middle of the body. B.S., blood-sinus; C.M., circular muscle-layer ; D.N., dorsal nerve ; D.V., dorsal blood-vessel ; <>!. , glandular \ayer of the integument ; Int., intestine ; L.M 1 . , inner longitudinal muscle-layer : L.M 2 . , outer longitudinal muscle-layer ; L.N., lateral nerve-stem ; N.P., nerve-plexus : P.S., cavity of proboscis-sheath.

KIG. .'. Portion of the outer part of the body-wall in transverse section, highly magnified. B.M., (secondary) basement-membrane ; C.M., layer of circular muscle-fibres ; C.T., connective tissue strands; Ep., external epithelium: <!!.. glandular layer ; GI 2 ., gland-cells of the epithelium; L.M 2 ., outer longitudinal muscles.

Fin. 4. Transverse section immediately behind the brain. B.8., blood-sinus ; C.C., cerebral canals ; C.M., circular muscle-layer; C.O., cerebral organ ; D.N., dorsal nerve; 1>.V., dorsal blood-vessel ; GL, glandular layer ; L.M 1 ., inner longitudinal muscle-layer ; L.M 2 ., outer longitudinal muscle-layer ; L.N., lateral nerve-stem passing outwards from the brain : P.S., cavity of proboscis-sheath ; V.B.8., ventral portion of blood-sinus.

Fin. 5. Transverse section through the middle region of the body of a female specimen. B.8., blood-sinus ; C.M., circular muscle-layer ; D.Y., dorsal blood vessel ; G., gonadial sac, filled with ova; Int., intestine ; L.M 1 ., inner longitudinal muscle-layer ; L.M 2 ., outer longitudinal muscle-layer ; P.S., cavity of proboscis-sheath.

FIR. 6. Transverse section through the proboscis, highly magnified. C., C., points where the circular muscle fibres cross each other dorsally mid ventrally ; X., longitudinal nerves.

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